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Commentary

Adult Health: A Legitimate Concern for Developing Countries

Margaret Phillips, MSc, Richard G. A. Feachem, PhD, DSc(Med), Christopher J. L. Murray, MD, DPhil, Mead Over, PhD, and Tord Kjellstrom, MD, MME

ABSTRACT

Adults, defined here as people between 15 and 59 years of age, in developing countries have a high risk of premature death and suffer from frequent morbidity and high rates of chronic impairment. Their ill health imposes a major burden on health services and large negative consequences on families, communities, and societies. This paper describes the level and impact of adult mortality and morbidity, and highlights some of its characteristics and causes, which in some cases contradict commonly held beliefs. It concludes that "adult health" is a legitimate public health concern for developing countries that is not being addressed. An agenda for remedial research and action is proposed. (*Am J Public Health.* 1993;83:1527–1530)

Introduction

In recent years, children have been the principal focus of public health research and policy formulation in developing countries. This attention has been easy to justify, particularly in environments of high infant mortality from preventable causes, and it has led to major advances in the case management and prevention of the communicable diseases of childhood. Nearly 90% of children born in developing countries now survive to be 15 years old owing to substantial reductions in child mortality.[1] However, many of the health problems of adults, including most noncommunicable diseases and injuries, have been neglected.

Adults, defined here as those individuals between 15 and 59 years of age, currently comprise 56% of the total population in developing countries, and this proportion is growing.[2] Adults include most of those in society who are economically productive, biologically reproductive, and responsible for the support of children and elderly dependents. Yet we remain ignorant about the nature and extent of health problems of this group. Adult health in developing countries receives scant attention in public health forums, in journals devoted to epidemiology and health services, and in international policy making. This paper, drawing substantially on work supported by the World Bank,[3] argues that such neglect is inappropriate.

The Level of Adult Ill Health

It is a common misperception that, once the hurdle of childhood is surmounted, the survival disadvantage of living in a developing country is small. Indeed, it is sometimes suggested that adult mortality is higher among the rich. In fact, the risk of a 15-year-old dying before reaching 60 years of age is 25% for men and 22% for women in developing countries, more than double that in the industrialized market economies, where the respective figures are 12% and 5%.[4] In some African countries (e.g. Sierra Leone), the adult mortality risk is more than 50%. Regional estimates of the risk of death between 15 and 60 years of age, together with the risk of death between birth and 5 years of age, are given in Table 1.

Death rates in children are higher than in adults and so, too, is the proportion of child deaths that could be classified as "avoidable" on the basis of comparisons with mortality rates in Japan, the country with the world's highest life expectancy. Nevertheless, more than one quarter of all deaths in developing countries occur in the adult age group, and about three quarters of these 16 million deaths are avoidable. Adults account for about 21% of all

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Note. The views expressed here are the authors' and do not necessarily represent those of the World Bank or its staff.

Editor's Note. See related articles in this issue's Public Health Policy Forum (p 1531).

TABLE 1—Model-Based Estimates of Regional Adult and Child Mortality Risk, by Region, 1988

Region	Risk of Death between 15 and 60 Years of Age, %		Risk of Death between Birth and 5 Years of Age, %	
	Male	Female	Male	Female
Developing world				
Asia	24	20	10	8
Latin America/Caribbean	23	15	8	6
Middle East/North Africa	27	23	13	11
Sub-Saharan Africa	38	32	18	16
Total	25	22	12	10
Industrialized world				
Market economy	12	5	1	1
Nonmarket economy	21	11	2	1

Note. Countries included in the industrialized nonmarket region are Albania, Bulgaria, Czechoslovakia (as was), East Germany (as was), Hungary, Poland, Romania, the Soviet Union (as was), and Yugoslavia (as was). The countries included in the industrialized market region are the rest of Europe, Australia, Canada, Japan, New Zealand, and the United States.

Source. Reprinted from Feachem et al.[3] with permission of the World Bank.

the avoidable years of life lost in developing countries, and for more than that if years are weighted for their productivity and discounted.[4]

The relationship between child and adult mortality is not particularly close: correlating the risk of death between birth and age 5 with that between ages 15 and 60, using data from all populations having recent mortality data, gives a multiple correlation coefficient of .77 for women and of .50 for men.[4] This has two important implications. First, it suggests that modeling adult mortality on patterns of childhood mortality is unlikely to generate accurate estimates. Second, it implies that policymakers cannot necessarily improve adult health by expanding policies that have been effective in controlling childhood illness.

Comparisons with Japan indicate that developing country women have an avoidable excess risk of death between 15 and 59 years of age of 16%, compared with 13% for men; this justifies the special attention given to the health problems of these women.[4] However, total adult mortality risk is actually higher in men than in women in nearly all developing countries and is strikingly so for several southern African countries, a situation that some have attributed to migrant work in South African mines.[5] In Latin America, absolute differences of more than 10 percentage points in the risk of death between ages 15 and 60 between the genders are common. These higher mortality risks in men can even be observed in the reproductive years despite the risks to women associated with childbearing.[4]

Documenting the overall nature of adult morbidity is much more difficult. Although specific disease studies are relatively common (and show high rates in adults for several important diseases), it is not easy to combine these to produce a balanced picture of the burden of morbidity. Household surveys of general morbidity point to high (although highly variable) levels of acute morbidity in developing country adults.[6] In large-scale World Bank surveys in Côte d'Ivoire, Peru, and Ghana, 33% to 45% of adults claimed to have been ill in the past month, with adults accounting for more than 50% of days ill and in the hospital. In Côte d'Ivoire, 20% of all adults claimed to be ill for at least 1 week in the past month, and 7% of them reported being ill for the whole month. Although revealing, these attempts to explore overall morbidity in a single survey also face problems: morbidity can only partly (and expensively) be measured using objective tests, and reliance on self-perceived morbidity introduces a subjectivity that is difficult to interpret. Much of the variation in reported morbidity reflects differences in illness perception and reporting, which may explain the counterintuitive result that reported morbidity is often higher in wealthier communities.[6]

Determinants and Causes of Adult Ill Health

Poverty is clearly associated with adult mortality. Adult mortality risks have been falling over time in most developing countries as overall conditions have improved, and cross-sectional analyses show an inverse relationship between the risk of adult death and gross domestic product per capita.[4] However, the exceptions are provocative. Why have Sri Lankan men, for example, not experienced a decline in mortality in the past 3 decades? Why do some countries (e.g., Costa Rica and Spain) have much lower adult mortality risk than would be predicted by their income, while others (e.g., the Seychelles and the United States) show the opposite?[4]

Some determinants appear to be particularly important in the early stages of development and are closely associated with general conditions in which individuals live.[7] Having a baby is risky in poor countries. Malnutrition and microdeficiency diseases (particularly of vitamin A, iodine, and iron) are important direct causes of some conditions and may indirectly increase susceptibility to many infections. Unhealthy domestic environments are associated with a variety of important communicable diseases, especially diarrhea and pneumonia. Communicable diseases, especially tuberculosis, which causes more than 25% of all preventable adults deaths,[4] explain a substantial part of the mortality differences between developed and developing countries.

These conditions are expected to decline with overall economic development, but this has not been the expectation for many noncommunicable diseases. Many unhealthy behaviors such as tobacco and alcohol consumption are becoming more prevalent with development.[8,9] Development also brings a variety of new environmental hazards.[10] Developing country cities generally have the worst pollution from suspended particulates and sulphur dioxide. Toxic wastes and poorly managed pesticide use are important sources of poisonings in developing countries. Deaths from workplace injuries are about 10 times more common in developing than in developed countries; the risk of dying from injury while working in agriculture in some developing countries is substantial (a risk of death between ages 15 and 60 of 2.4%).[7] Vehicle collisions cause about 0.5 million deaths a year and a similar number of victims with permanent impairment.

In fact, noncommunicable diseases, rather than "tropical" or other communicable diseases, are the leading causes of adult death in developing countries. This is even true in very poor countries like Bangladesh, where the burden of communicable diseases remains high.[11] In those countries possessing adequate data, about 72% of the mortality risk for men between 15 and 59 years (and 82% of that for women) is from noncommunicable causes, and 23% for men (and 11% for women) is from injuries. Cardiovascular diseases rank first for both men and women, neoplasms rank second for women, and neoplasms and unintentional injuries rank in the top five for men.[4]

Noncommunicable diseases, commonly thought of as diseases of the rich, actually cause higher rates of death in poor countries and among poorer people within a country. For example, a recent study in Brazil shows that groups with lower income and less education have higher mortality rates from cancer, cardiovascular diseases, and other noncommunicable diseases and injuries.[12] Data from China illustrate the same phenomenon (Table 2). Age-specific mortality rates from noncommunicable diseases in general (and cardiovascular diseases in particular) are declining in many developing countries. For the few countries with cause-specific time series data, reductions in noncommunicable diseases explain about 50% of the overall decline in the risk of death between the ages of 15 and 60 for both men and women.[4] In other words, development does not appear to be provoking "epidemics" of noncommunicable disease, although it is true that both the absolute number of cases and the relative importance of these diseases are increasing largely because of the changing age structure of the population.

TABLE 2—Adult Female Mortality Risk (%) between 15 and 60 Years of Age for Three Groups of Causes of Death in China, 1987 through 1988

Income Quartile	Communicable and Reproductive Diseases	Noncommunicable Diseases	Injuries	Total
I (highest)	0.4	6.7	1.2	8.3
II	0.4	7.9	2.0	10.3
III	0.6	7.6	2.4	10.6
IV (lowest)	1.4	8.9	2.7	13.0

Source. Reprinted from Feachem et al.[3] with permission of the World Bank.

The failure to observe increases in mortality rates from noncommunicable diseases in adults as countries progress economically remains a puzzle. Westernization and concomitant changes in diet, smoking, and life-style are thought to increase noncommunicable disease rates. The apparently inverse association between the rates of noncommunicable diseases and their putative risk factors might be explained by previously unknown or underestimated etiologies, or perhaps by improvements in medical services postponing death until after 60 years. Some risk factors may be ameliorated by the adoption of protective measures such as pollution controls; occupational safety improvements; and better roads, cars, and drivers. In addition, the lag between unhealthy behavior and subsequent mortality may mean that the negative health consequences are still to come.

The Impact of Adult Ill Health

Both the relative and absolute importance of adults and their health problems are increasing, despite the fact that age-specific death rates from many diseases (including noncommunicable ones) are falling. The absolute increases arise because of a growing adult population fed by previous or current high fertility. The relative increases are the result of a combination of factors: the aging of the population (with adults forming an increasing percentage of the total population), more rapid declines in exposure to risk factors that affect childhood diseases than to risk factors contributing to adult diseases, and more substantial improvements in therapeutic and preventive strategies for communicable diseases of children than for noncommunicable diseases of adults.[2]

Adults comprise the great majority of the labor force, and it is to be expected that adult ill health would have deleterious effects on productivity. Some studies have indeed demonstrated this.[13–16] In general, however, the evidence is surprisingly weak. There are good reasons to believe that many studies fail to detect productivity effects, not because such effects are not present or not substantial, but because they are obscured or delayed through compensatory reallocations of labor away from other income-generating activities, child care, or education, and that the study designs have not been sophisticated enough to capture these effects[17]: sick workers may do less work at home so as to maintain productivity on the job; family or friends may be drawn from other productive employment to substitute for the ill individual; children may be kept away from school to help; and employers who hire from a sickly work force may build slack into their production schedules and avoid labor specialization.

Illness in adults places considerable demands on health services. Most countries spend at least a half of their health budgets on hospitals, and in countries with data, at least 70% of hospital costs are for adults and the elderly. Adults suffer more from noncommunicable diseases than do younger age groups, and these diseases tend to be expensive to treat. Population-based surveys of medical expenditures reveal that adults spend more on their own health care than on that of other age groups (e.g., 62% of total out-of-pocket medical expenditures in Côte d'Ivoire, according to a World Bank survey.[6]

In the poorest households, ill health of an adult can be catastrophic. Poor adults suffer more often from severe ill health, and are more likely than wealthier ones to depend on regular physical work and to have fewer resources with which to cope. The combination of lost income and the need for major medical expenses in such households can lead to asset sale, debt, and impoverishment. One study in Thailand found that 60% of involuntary land sales were owing to ill health.[18] In Bangladesh, six out of seven households with an ill breadwinner had debts averaging more than four times their monthly income and five times the average level of household indebtedness in that urban slum.[19] Adult illness can even kill other members of the family. Studies in Bangladesh have found that the mortality rates of infants whose mothers die can be as high as 95%,[20] with the death of a mother associated with up to a 10-fold increase in the risk of death in her children.[11]

Countries and communities adopt a wide variety of measures either to cushion the effects of ill health, should it happen, or to reduce the chances of getting ill.[17] Informal insurance mechanisms include alliances through marriage, reciprocal financial transfers that may never be recouped, and savings in relatively liquid forms (which may reduce the scope and hence productivity of investments). Both formal and informal insurance mechanisms are imperfect and involve costs that would not be incurred if individuals knew they were highly unlikely to get ill.

Implications for Research and Action

One response to data showing that adults in developing countries suffer from serious health problems is to spend more on improving adult health. Since much of the current investment in adult health is inequitable or inefficient, more of the same is not desirable. However, some interventions to improve adult health have not received the attention they deserve, given the substantial health returns they promise per dollar invested.[21] These include certain preventive strategies (notably, to reduce smoking; to promote safer travel, sex, and motherhood; and to reduce liver cancer through vaccination) as well as improved case management (particularly of tuberculosis and diabetes), screening against cervical cancer, and pain relief for cancer patients.

Just how appropriate particular investments will be for any given country depends on many factors, including the epidemiological context and the technical, economic, and political environment in which health policies are implemented. It is unlikely that shifting resources away from children to adults, or from communicable to chronic diseases, can be justified on efficiency or equity grounds; some of the best investments are still in the control of childhood communicable diseases.[21] However, many countries devote substantial public resources to costly and marginally effective treatments of adult diseases, and governments should explore realistic options for withdrawing public funding from such services.

More information is needed on adult mortality and morbidity in the poorest countries, particularly those in sub-Saharan Africa and South Asia. The consequences of adult ill health also deserve closer study. Basic research in developing countries on the pathology of diseases or on the nature of associations between adult diseases and their risk factors is difficult to justify in most cases. What developing countries do need are data on the levels and determinants of exposure to major risk factors so that interventions can be appropriately designed and targeted.[7] Finally, a large body of research remains to be done on the cost-effectiveness of curative and preventive interventions against adult diseases.

Because of ignorance concerning the nature of adult ill health and the cost-effectiveness of potential interventions, policy development in the area of adult health is weak.[22] There are no adult equivalents to the well-researched, thoughtfully developed, and enthusiastically promoted child health programs. The political pressures to respond to the health problems of adults will continue. Governments need the courage and the facts to redirect expenditures into more cost-effective treatment or prevention. "Adult health" must be firmly on the agenda of developing country health policymakers and researchers. □

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A Developing Country's University Oriented toward Strengthening Health Systems: Challenges and Results

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ABSTRACT

Objectives. The Aga Khan University in Karachi has a mission to educate leaders and to contribute to the development of health systems for Pakistan amid challenges of scarcity and complexity.

Methods. Its key activities are (1) to design and test urban and rural health system prototypes, (2) to develop faculty in medical and nursing postgraduate community health sciences programs, and (3) to design and implement community-based undergraduate medical and nursing curricula.

Results. The university has developed equity-based, cost-effective primary health care prototypes in Karachi slums. With government counterparts it has tested village-, facility-, and district-level interventions in a poor rural district. Federal policymakers have taken models from each for widespread replication. The university is training 49 medical and 19 nursing faculty for postgraduate programs in community health sciences. Most faculty retain institutional leadership positions, including teaching community-based, problem-solving, community health sciences as 20% of the medical and nursing undergraduate curriculum.

Conclusions. The mission and experience of the Aga Khan University in population-based health systems design and health sciences education can guide universities in both developing and developed countries. (*Am J Public Health.* 1993;83:1537–1543)

The Aga Khan University: Challenges, Mission, Objectives

A university in a developing country faces a particularly daunting task as it seeks development amid pervasive underdevelopment. The familiar landscape is a web of scarcity and complexity, the most obvious components of which are widespread ill health; unchecked population growth; and inequitably distributed, largely ineffective health services. Present mortality and morbidity are likely to remain high, given demographic trends and the context of political instability, economic stagnation, inappropriate technology, and value transfers, all of which exist against a backdrop of habitual disregard for or exploitation of the poor.

The Aga Khan University is the first private university in Pakistan. Because it is 10 years old, its facilities, faculty, research capacity, and institutional maturity seem a limited match for the country's formidable problems. This tension between calling and capacity leads to an inquiry into the university's role.[1] Should it venture into society, risking failure and even its stability? Or should it remain cloistered, risking relevance and missed opportunity? Grappling with these issues, the health sciences faculty has advocated concerted interaction with communities, government, and the health system,[2] both public and private. This role is thus reflected in the university's mission statement:

> The Aga Khan University Medical Center is dedicated to providing exemplary education, research and service, oriented toward finding and disseminating innovations to improve the health of the people of Pakistan and the developing world. (Report of the Aga Khan University Medical Center Committee of the Board of Trustees, March 1993.)

The Department of Community Health Sciences has two main objectives: (1) to strengthen the development of health systems in Pakistan through education and research, with emphasis on the development and implementation of health system prototypes in collaboration with local and national authorities; and (2) to educate health personnel for leadership in dealing with health and development problems, particularly those of the more deprived communities of Pakistan. To what extent has the university accomplished these goals? How generalizable are the findings? Enough has now been learned to justify a report on the university's experience in developing health systems and in educating health personnel. The following analysis examines the problems that were addressed, the university's programmatic response, the results to date, and a commentary.

Health System Development

The university has pursued the development of health system prototypes in both urban and rural settings. Each setting has been uniquely challenging; both have been essential for progress toward health.

The University's Urban Primary Health Care Program

The problem: Given the extensive needs of urban populations living in extreme poverty, coupled with serious inadequacies of governmental health services, is it possible for the university to develop prototypes of urban primary health care[3,4] systems that are effective, affordable, and amenable to large-scale replication?

Karachi is a rapidly growing, sharply changing city with a population that approaches 10 million. The millions of underprivileged people pose a chronic crisis, a "paradox of development that perpetuates under-development."[5(p10)] Large portions of the burgeoning population coalesce into

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TABLE 1—Selected Baseline Health and Demographic Indicators: Aga Khan University's Urban Primary Health Care Prototypes[a]

	Group A[b] Prototypes						Group B[b] Prototypes	
Indicator	Orangi	Chanessar Goth	Grax	Essa Nagri	Azam Basti	All Five Sites	Baba Island	Karimabad
Infant mortality rate	110	121	170	144	93	126	210	33
Under 5 yrs of age mortality rate	130	171	294	230	111	177	NA	NA
Crude birth rate	41	41	44	44	41	41	39	16
Crude death rate	10	11	15	18	11	10	20	56
Contraceptive prevalence rate	NA	7	6	12	15	. . .	13	56

Notes: NA = not available.

[a]Baseline surveys were carried out at one to two sites yearly, 1985 to 1989.

[b]Group A = University-led prototypes (more complete data); group B = community-led prototypes.

katchi abadis, slums characterized by poverty, lack of education, contamination, political instability, ethnic violence, and drug running. In the urban setting, government services are fragmented, skewed toward large hospitals, and unable to meet the needs of the poor.

Thus, the university has developed health system prototypes: small, community-based systems that are amenable to study, adaptation, and ultimately large-scale replication. It has seven such modules scattered in Karachi. Six are located in the katchi abadis, each serving a community of about 10 000. Baseline socioeconomic, health, and demographic surveys of these prototypes (Table 1) show high crude birth rates, high infant mortality rates, and high prevalences of infectious diseases and malnutrition (the impact indicators), along with low incomes, overcrowding, illiteracy, and lack of civic amenities.

The seventh site, Karimabad, is a lower-middle-income area. Its lower birth and infant mortality rates, higher contraceptive prevalence rates, and disease patterns similar to those of industrialized countries attest to its progress through the demographic and epidemiological transition.[6] We have coined the term *child mortality burden*[7] as an indicator of the health transition; it is defined by the percentage of total annual mortality affecting children under age 5. In the slums this figure exceeds 50%; at Karimabad it is 18%.

The response: The university has taken three approaches to primary health care in these urban settings: a university-led, a community-led, and a joint health promotion/disease prevention program.

- The university-led model. Five of the urban modules (Table 1, group A) follow the university design of community-based programs, incorporating the World Health Organization's principles of health for all: universal coverage, care according to need, and community participation. This health care system has three tiers of health personnel. At its base are community health workers: women recruited from and trained in the community. These workers are supported by paramedical lady health visitors, who are supervised by a community health nurse and a community health doctor.

The community health workers are the key to equity and coverage, as each worker monitors approximately 125 households, visiting each household monthly. Those people who are ill or at risk are given priority attention. These workers emphasize immunizations, growth monitoring, oral rehydration therapy, and early recognition of acute lower respiratory infections among children; additionally, they identify high-risk pregnant women and advise on family planning.

Simple curative services are available in small health centers. Community participation is encouraged in the programs, as are other health-related activities like income generation, education, and pressing for adequate supplies of clean water and sanitation. To track coverage, effectiveness, and costs of the program, a management information system uses the community health workers' data. Nurses review and aggregate the data; feed it back to the primary health care team; and forward it to the university for computerization, further analysis, and feedback.

- The community-managed model. The model on Baba Island (Table 1, group B), home to fishermen and their families in Karachi harbor, differs from the university-led model. A strong local nongovernmental organization, the Fishermen's Welfare Association, stimulated the community to want to understand the causes for its ill health. Since the decision making was shared between the university and the community, health system development evolved more slowly than in the university-led model.

- The health promotion/disease prevention model. The Karimabad health promotion/disease prevention program (Table 1, group B) enlists community volunteers and private medical personnel as agents for early identification of risk groups, improved health and disease awareness, changed attitudes and practices, and improved management of "posttransition" diseases.

The university-led urban programs have demonstrated improvements in coverage and impact indicators. The infant mortality rate has fallen from 126 to 64; the under-5 mortality rate, from 177 to 83; and the 1 to 4 mortality rate, from 51 to 19 (Table 2).

In 1991, annual costs of these university-led systems averaged US $3.12 per person in the population, or US $12 per woman of childbearing age and child under 5. Backup, off-site managerial costs increased the per capita cost to US $4.00 (Table 3). Table 4 shows the cost allocation to individual components, including curative care, 39.5%; child nutrition, 20.4%; and immunizations, 16.6%.

Although these communities have had gratifying reductions in the infant and young child mortality rates at affordable costs, these quasi-experiments have had no comparison populations in which health status was monitored without interventions. Thus, additional qualitatively comparable katchi abadis communities are being studied to clarify secular trend questions. Nevertheless, on the basis of these prototypes, the government of Sindh Province has asked the Aga Khan University to assist in developing a large-scale urban health care system, financed by the government and the World Bank.

The University's Program for Rural Health System Development

The problem: Given the extreme problems of underdevelopment in impoverished rural settings and an inadequate health system, is it feasible for a university to help strengthen the governmental health system?

Collaborating with the government to improve health in rural settings is a great challenge. Poverty, inequity, insecurity, women's seclusion, and a woefully inadequate infrastructure for communication, transportation, and education make rural primary health care a task well beyond the capabilities of traditional health interventions.

The government has built a substantial health services infrastructure, but this is beset by deep-seated problems of finance, vision, management, accountability, program content, and staffing. For example, there are few female health staff members, a critical problem in this society. Services are marginally acceptable because of drug shortages and the uneven quality of care; this, in turn, has resulted in their paradoxical underuse by an underserved, unhealthy population. Despite a dismal infant mortality rate of 172, health services use is as low as 0.2 visits per person per year.

The response: The university has worked with the government to advance its capacity for conceptualizing, staffing, and managing the system, including reaching communities with primary health care. This was a top priority because a university-led rural prototype developed independently of the government would have little relevance for sustainability or large-scale replication. The preimplementation phase has been qualitative, emphasizing relation building, method testing, and system strengthening. The follow-on implementation phase, now under way, will test and quantitatively monitor interventions undertaken jointly with the government.

Our health systems research project in Thatta District (population of about 1 million), designed in collaboration with the government of Sindh Province to strengthen the health care system, explores interventions at three levels: district, facility with catchment population, and village. These three levels of approach are being compared in their capacities to improve health status. The district level focuses on strengthening district health management, especially management information systems, and on developing female health personnel. Facility-level interventions include center- and community-based primary health care services and a first referral-level hospital. The village focus is to improve health through schools and to enhance village self-development ability.

The outcomes to date include (1) a better understanding of the sociopolitical context of government personnel and rural communities, (2) a modification of the training and system design consistent with extreme underdevelopment and political instability, (3) improved governmental and community capacities, and, importantly, (4) changed governmental attitudes. Less prone to hopelessly lament their limited resources, doctor-managers now consider using such resources more efficiently. The university's capacity and educational programs have also grown. Junior faculty have learned operations research firsthand. Medical and nursing students who might rarely leave Karachi have experienced the challenges of meeting health needs amid rural poverty. Specific programmatic achievements are as follows.

- At the district level. The District Health Management Team evolved over 2 years, through a series of phases, from the districtwide management training component (see Appendix A). By recognizing and encouraging the early interest of participants, the university enhanced these participants' confidence and leadership capacity. The initial training in management encompassed both technical issues and more abstract topics, such as concept development, communication, and community involvement. Indeed, using these

TABLE 2—Impact Indicators for Five Urban Field Sites (Group A): 1991 Compared with 1985–1988 Baseline

Indicator	1985–1988		1991		% Change in Rate
	n	Rate[a]	n	Rate[a]	
Population	38 151	...	47 280	...	...
Births	1 556	41	1 442	31	−24
Deaths					
<1 y	196	126	92	64	−49
<5 y	275	177	120	83	−53
1 to 4 y	79	51	28	19	−63
All deaths	400	10	281	6	−40

[a] Rates per 1000.

TABLE 3—Costs by Budget Line for Five Urban Field Sites (Group A), 1991

Expenses	%	Amount Pak Rupees[a]	US $
Salaries	75.1	3 011 246	$120 450
Drug, vaccines, medical supplies	10.3	414 705	16 588
Other supplies	4.0	161 749	6 470
Building	5.8	231 781	9 271
Transport	1.9	75 765	3 031
Training	0.3	12 497	500
Depreciation	2.5	99 925	3 997
Total	100.0	4 007 668	160 307
Total less cost for nonregistered area clients		3 676 537	147 062
Per capita		78	3
University management and faculty expenses		1 064 690	42 588
Total cost per capita		100	4

[a] US $1 = Pak rupee 25 (1991).

TABLE 4—Costs[a] by Program Component for Five Urban Field Sites (Group A), 1991

Component	%
Basic curative care	39.5
Child nutrition	20.4
Immunizations	16.6
Antenatal care	11.7
Family planning	5.9
Health education—additional topics	2.9
Oral rehydration/diarrhea control	3.0

[a] Total cost = US $147 062.

ideas, the trainees became part of the evolving management team, which is now a model of participatory health system problem solving for the province.

Female health personnel have received special training, encouragement, and security assurance. Their knowledge as measured by pre- and posttests has improved, and use of their services has increased. In another initiative, 112 village health volunteers from the catchment area of 20 facilities were trained in basic health activities. Unfortunately, because of inadequate supervision, only 18% remained active after 1 year. But although the program could not be sustained in this form, the government has endorsed its value by seeking outside funding to strengthen it. A major achievement is the university's contribution to the Health Management Information System, which spans the facility and the district and has been accepted for national use.

- At the facility level. In the catchment areas of two facilities, 35 villagers received basic primary health care training. After 2 years with minimal support, 50% of these villagers remain active, and they are enthusiastic about their new capacity for contributing to socioeconomic progress. In another example, usage rates for facility-based antenatal care have increased by 64%. This care is accepted if female staff are reliably available, a crucial strategy to reduce the estimated maternal mortality rate of 1%.
- At the village level. Despite a rural educational system that is even weaker than the health care system, a pilot program has trained 12 teachers in interactive teaching methods. In turn, these teachers have designed and taught modules of six health promotion lesson plans to eager children. Village development workshops have encouraged rural women to identify their own problems, formulate solutions, and take collective action. Because of the lengthy preparatory work required in a setting of feudal inertia, the effects of these workshops at the geographic periphery have thus far been confined to promotion of some health activities and enhanced awareness and organization of certain social groups.

Overall, a strengthened health system is emerging that can initiate and track interventions. Although quantitative evidence for effective, affordable, lasting change awaits further experience, the process has been noted by policymakers. The Thatta project has become the prototype for the government of Pakistan's World Bank-supported Family Health Project, which will serve the 18 million people in every rural district of Sindh Province.

Training and Education for National Health Development

Our programs for human resource development address postgraduates and undergraduates.

Faculty Development: The Aga Khan University Scholars in Community Health Sciences

The problem: Symptomatic of underdevelopment is a scarcity of skilled manpower in community health. How can the Department of Community Health Sciences train leaders in community health and health system development?

The response: The strategy to accomplish this ambitious goal is the Aga Khan University Scholars faculty development track. Now in its ninth year, the program began with a handful of senior faculty and some young Pakistani health professionals. These initial instructor trainees entered a long-term career development track at the completion of which was an uncertain job market. The training they undergo and the wide-ranging jobs these instructors are trained for are described below.

- Community health doctors. Upon entering the program, each physician attends a 6-week "mini–master's degree in public health" orientation to community health. Then, as community health doctors, they join either a rural or an urban field team; as instructors, they teach classroom and field tutorials in the medical college and attend weekly seminars that anticipate teaching responsibilities.

After 3 years of increasing responsibility in the classroom, field, and department, the average instructor has served as a team director and a tutor while developing areas of research and clinical interest. Those recognized as having outstanding research or teaching potential are designated as Aga Khan University Scholars, invited to remain as department faculty, and supported to get a master's degree in their fourth year. Others with different talents needed in Pakistan, such as skills in health system development, primary health care technology, and field work, are assisted in career planning.

Upon their return from master's degree studies, senior instructors assume larger responsibilities in teaching, mentoring, health system development, and research. Many young faculty fill key roles in program development. Years 5 to 7 are spent perfecting skills and defining areas of interest as each instructor plans for doctoral studies and further career development.

- Community health nurses. The community health nurse scholar career development track is smaller, newer, and equally important. Because the nursing profession in Pakistan has long been scorned as unsuitable for young, single Muslim girls, the challenge is both to train nursing leaders[8] and role models *and* to change entrenched attitudes.

Community health nurses join the department after 3 years of diploma nursing and 1 year of midwifery training. As field team members, each works in service, teaching, and management. After 2 years, the nurse enters the 2-year bachelor of science in nursing program. She then works for 2 years refining skills in management, teaching, or field supervision, after which she may apply for master's studies.

To date, the programs are training 49 physician leaders and 19 nurse leaders, numbers that are increasing annually. The faculty development program has a good retention record: more than 45 doctors and nurses are currently in this program, some for as long as 9 years.

The faculty trainees have been monitored rigorously, both internally and externally. Prior to being selected as university scholar in the third year, each trainee receives a series of exacting annual appraisals—qualitative and quantitative evaluations by self, peers, and seniors. Focused, accountable correctives are instituted for lagging performance while acceptable progress is rewarded with new responsibilities. The validity of the internal evaluations is confirmed by virtually every scholar who has excelled in competitive master's programs (such as Harvard, Johns Hopkins, and London). Some scholars have earned degrees with distinction and prizes for scholarship.

The quality of these emerging professionals is confirmed by the array of career opportunities that lie open to them. Nongovernmental organizations and the government have sought consultancies and short-term placements. However, as a gratifying indicator of the scholars' views of this career development track, only 2 of 31 have left the program. Yet, they, too, have assumed important positions in health and development in Pakistan, and the department seeks honorary designations for them. In sum, these young faculty are the key to the university's innovations in community-based, health system-oriented medical and nursing education, as well as in health system development.

Finally, the instructor/scholar sequence is expensive, averaging US $20 000 per year abroad. The need for an in-country graduate program is obvious. Additionally, the department envisions shorter certificate courses to help educate government and nongovernmental organization personnel who are already committed to working in Pakistan.

Medical and Nursing Undergraduate Education: A Community-Based Approach

The problem: Community health has been accorded low priority and little respect in Pakistan's medical and nursing education. Is it feasible for the university to train its own doctors and nurses for leadership in this field? Can it influence other universities' programs or national health education policy?

The response: Medical and nursing education benefits from the interaction between faculty and health system development. Population-based prototypes serve multiple purposes: they are vehicles for the health and development of deprived populations, training sites for faculty, and settings for students to learn the attitudes and activities of community health from the first month of their medical and nursing careers. Because much of the work is unique and uncharted, communities, students, and young faculty learn as they solve problems together.

- Community health sciences in the medical curriculum. The 20% of the curriculum devoted to community health allows for student learning in socially sensitive and methodologically sound ways that are problem oriented, student centered, competency based, and community based. The 5-year teaching-learning sequence follows a problem-solving process known as the community health planning cycle: community assessment, problem identification and prioritization, vertical and then integrated planning, implementation, and evaluation (Appendix B).

The curriculum is divided into preclinical and clinical phases, 2.5 years in each. Community health sciences are taught through each of the 6 preclinical terms: 2 hours per week in lectures and 5 hours per week in small group tutorials or fieldwork (Appendix B). During the clinical years, quantitative skills are applied to carry out small research projects or health system evaluations. Likewise, clinical skills, taught jointly with the Departments of Pediatrics, Obstetrics/Gynecology, Family Medicine, and Community Health Sciences, are learned through clerkships at several field sites.

Each added field site is unique, as successive classes have learned through community assessments, interventions, and studies. Students benefit from the studies of these field sites. A group of 5th-year students tactfully pretested quality assurance instruments; another group analyzed the potential for using prototypes for large-scale, sustainable replication.

- Community health in the nursing curriculum. The Aga Khan University School of Nursing is unique in Pakistan in that it designates 15% of its diploma curriculum to community health. Educational opportunities for nurses expanded with the 1988 introduction of a two-year postbasic bachelor of science in nursing degree program. Offering the only university degree available for nurses in the country, this program devotes 26% of its curriculum to community health covering fields such as management, education, research, and surveillance. Moreover, the School of Nursing has advised the Pakistan Nursing Council regarding the content of the national community health nursing curriculum and has trained the first tutors.

The undergraduate programs in medicine and nursing can be assessed in terms of the graduates' acquired knowledge, attitudes, skills, and career choices. While educationists grapple with methods to assess the quality of medical curricula,[9] our graduates have a strong foundation in basic, clinical, and community health sciences for addressing the health needs of Pakistan. Desiring to compare their academic performance to an international standard, the first graduating class of medical students asked to take the Canadian Comprehensive Examination. They performed, on average, slightly better than their North American peers (S. C. Robinson, personal communication, 1992).

How the graduates will use their community health experience is less clear. Only five classes of medical students have graduated, and most of those students have opted for postgraduate studies in the United States or United Kingdom. Most speak of returning to confront Pakistan's health problems. Some talk of community health; more imagine a dual focus of a clinical specialty linked with community health, such as community pediatrics. Our medical graduates, like those elsewhere, face multiple factors influencing their career choices: personal and family values, uncertainty of career opportunities, faculty role models, economic considerations, and national need.

Similar comments apply to nursing, which also offers a strong undergraduate program in community health nursing, followed by an uncertain process for graduates sorting out further training needs, career options, and family decisions.

The contrasting commitment between the undergraduate and postgraduate programs no doubt relates to differing selection criteria, professional commitments, and evolving career opportunities. Tracking our graduates' career plans and choices continues.

One strategy for achieving the university's mission in medical education reaches beyond the institution to collaboration with other universities in health and development. For example, the 1993 Workshop on National Priorities in Health Sciences Education called for major nationwide curriculum changes toward population-based orientation, and the Pakistan Medical and Dental Council is asking the university to help develop the implementation strategies.

Conclusions

The Aga Khan University, a university in a developing country, is addressing the problems of severe underdevelopment in the health sector through health system development and education for leadership in the field. In each case, we have defined the dominant problem, reviewed our programmatic response, and analyzed the effectiveness of the results. In several instances, the university's work on prototypes of health systems and educational programs has resulted in policy changes by the government.

Of note, the university's activities are not confined to educational and system development. The department actively conducts research that is guided by health system questions and that guides curriculum. For example, inquiries into maternal management of child illness and household risk factors for child death probe the social determinants of the health transition. And students conduct focus group discussions probing into mothers' perceptions of and response to childhood diarrhea. On a national scale, the department oversees the Maternal and Infant Mortality Survey of 40 000 households in all four provinces, the results of which will strengthen the university's linkages with the government and guide policy. Moreover, the Pakistan Medical Research Council has asked the department to advise it regarding research priorities and capacity building for research.[10]

What can be said about the *generalizability* of our experience to other universities in developing countries? The salient question is, how feasible is it for universities to engage in health system development? It is feasible, depending on the extent of university interest, commitment, and resources. Faculty and staff must have—or be willing to develop—the relevant disciplinary backgrounds: health system planning and management, epidemiology, and sociopolitical skills to interact with communities and government. Financial resources are necessary for fieldwork and system development; however, field activities can be undertaken at low cost and can greatly stimulate a university's thinking in system development. The *process* of pursuing constructive change under conditions of underdevelopment requires faculty who sensitively press for change and an institutional orientation that rewards advances in education and health system development as well as more conventional research.

Regarding faculty development, our experience can guide similar universities' institutional growth in this field. The lack of trained, interested faculty is a commonly cited obstacle that precludes a university's pursuit of health system development. But our university did not begin with strong expertise in this field. Instead, a few committed senior faculty recruited interested young people and trained them in the field to learn of individual, community, and health system problems and opportunities, while supporting and monitoring their professional maturation. Note that our university is not unique in health system development activities. Many universities in both developed and developing countries have similar missions.[11,12]

The undergraduate educational programs are also generalizable to other universities in developing countries. While other universities have more experience in innovative teaching methods, our strength is our extensive involvement in community-based education in the context of health system development.

This paper adds to the current debate on change in medical and nursing education, including the growing practice of universities to establish community- and population-based education and health care programs.[13] Such institutions accept responsibility for the health of a defined population, this responsibility includes not only involvement in health care guided by epidemiological methods but also advocacy for those populations.[14] The Aga Khan University's experience should encourage other like-minded universities in both developed and developing countries. Indeed, here universities share a common agenda regardless of their societies' development. ☐

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APPENDIX A—Management Training Evolves Into a District Health Management Team (DHMT)

Initiation of training

1. Initiating management training: 22 medical officers selected by participatory approach
2. Trainees planning training: need for trainee participation recognized after first workshop

Growth of individuals

3. Making case studies: "resource trainees" volunteer to help make real-life case studies
4. Making/facilitating modules: resource trainees help design and implement whole modules
5. Identifying new issues: issues beyond the curriculum—transfers, political interference
6. Training trainers: DHO seeks plan, curriculum, and trainers for World Health Organization's VHV Programme

Growth of the team

7. Defining DHMT: as program evolves—new name (DHMT) and terms of reference
8. Expanding role: problem solving—reporting defaulters, low utilization, etc.
9. Increasing participation: female and community participation debated and female joins
10. Team approach: DHMT responds to 2^0 hospital's request for situation analysis
11. Meeting policy makers: DHMT concept approved for Sindh Province
12. Institutionalizing DHMT: DHMT and DG Health-Sindh review institutionalization

Note. DHO = district health officer; VHV = village health volunteer; DG Health-Sindh = director general of health of Sindh Province.

APPENDIX B—Medical Curriculum: Preclinical and Clinical Courses by Year of Study and Content

Course	Year	Content
		Preclinical phase
Community, health, and development	1	Introduction to development, risk groups, and primary health care in the context of Pakistan and Aga Khan University
Community assessment	1	Epidemiology, biostatistics, demography, and qualitative methods to design/implement/analyze field survey
Health services assessment; occupational health	2	A macroview of assessment and an introduction to Pakistan's occupational health challenges
Primary health care technologies	2	Biomedical, technical, social, and managerial aspects of primary health care components
Planning	2	Equipped with micro- and macroassessment tools plus ranges of strategies and activities, students design a response
Biomedical ethics and clinical epidemiology	3	The ethical and epidemiological dimensions of the clinical and community encounter—a bridge to the clinical years
		Clinical phase
Primary health care technologies	3	Student groups explore technologies: appropriateness, effectiveness, and affordability over 2 months
Research methodology	4	Student groups design, implement, analyze, and report a supervised study over 1 month
Evaluation methodology	5	Student groups perform a detailed evaluation of part of an existing health system over 3 months

Physicians Who Have Practiced in Both the United States and Canada Compare the Systems

ABSTRACT

Objectives. The aim of this study was to examine the US and Canadian systems from the unique perspective of physicians who have practiced in both Canada and the United States.

Methods. Questionnaires were sent to 355 Canadian physicians who graduated from US medical schools and 347 US physicians who graduated from Canadian medical schools.

Results. The overall response rate was 59% (65% of US-graduated Canadian physicians and 54% of Canadian-graduated US physicians). Thirty-six percent of the respondents were "dual experience" physicians; that is, they had practiced medicine in both countries after completing their medical training. Physicians who left Canada were more likely than those who left the United States to indicate dissatisfaction with the health care system as a reason for leaving. Respondents expressed greater professional satisfaction with their current country of practice, but overall, dual-experience physicians in the United States favored that system only slightly more than the Canadian system, whereas those in Canada rated the Canadian system significantly better than the US system.

Conclusions. The comparatively weak rating of the US system by dual-experience physicians underlines the need for health care reform. (*Am J Public Health.* 1993; 83:1544–1548)

Gregory J. Hayes, MD, MPH, Steven C. Hayes, PhD, and Thane Dykstra, BA

Introduction

In the United States, interest in the Canadian health care system is widespread.[1–3] A large percentage of the US public favors extensive health care reform.[4] Proposals for reform have sometimes drawn heavily on the Canadian model,[5] although this model has been viewed with skepticism by others.[6–8] Such skepticism has been fueled by signs of increasing stress within the Canadian system in recent years. Rising costs, efforts at cost control in the face of increasing benefits, and stagnant or depressed earnings among physicians have placed the Canadian health care system in jeopardy.[9–12]

Analytical comparisons between the US and Canadian health care systems can sometimes exclude the human side of the equation.[13–14] Given the close proximity of Canada to the United States, a sizable number of health professionals have had direct experience as providers in both systems. These physicians have a unique perspective that should be of particular interest to those seeking insights into methods of health care delivery. Yet the literature on the subject to date has been limited.[15–17] The current study takes this inquiry a step further.

Methods

Using the 1987 Canadian Medical Directory, we identified all Canadian physicians (488) who had graduated from US medical schools. The use of an older directory allowed for a minimum number of years of professional experience in Canada. A similar-sized group (533) of graduates of Canadian medical schools now practicing in the United States was gathered by identifying the first Canadian medical school graduate on every fifth page of the 1988 American Medical Association Directory. (There are about 17 times more Canadian-graduated US physicians than US-graduated Canadian physicians; each group represents roughly 1% of its respective work force.) Addresses for both groups were then updated, using the 1990 directories for both countries. We sought to identify physicians who had had direct professional experience in both the United States and Canada, without a requirement as to original country of residence. The respondents thus included individuals with a variety of backgrounds and included both Canadian and US citizens who attended medical school outside their own country, some of whom stayed on to receive further medical training or to practice medicine before returning to their own country.

Questionnaires were mailed to 813 physicians so identified for whom current addresses were available. Questionnaires proved deliverable to 702 physicians (355 Canadian and 347 US) and 414 were returned, 232 (65%) from Canadian physicians and 182 (54%) from US physicians (overall response rate, 59%).

Results

Of the 414 respondents, 256 (62%) obtained additional professional training (internships, residencies, and/or fellowships) in the same country as their medical school. Further, 147 respondents (36%)

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practiced medicine in both countries after medical training, averaging 10.43 years of experience in the Canadian system and 10.98 years in the US system. We will refer to this group as "dual experience" physicians.

Men made up 76% of the sample and women 20% (4% did not report their sex). The respondents were predominantly (88%) White. Five percent were Black, Asian, or Hispanic (7% did not report their race/ethnicity). Age was reported in 10-year increments. The predominant age group was 40 through 49 years of age, especially in the Canadian sample, where 49% of all respondents fell into this age group.

Respondents were divided into two groups. "Primary care providers" included those practicing in nonsurgical areas of medicine that traditionally provide primary care services the majority of the time: general practice, family practice, pediatrics, and internal medicine (including geriatric medicine). All others were classified as "non–primary care specialists." The sample consisted of 166 (40%) primary care physicians and 234 (57%) non–primary care specialists (3% did not report their field of practice).

The questionnaire focused on global measures of satisfaction with the respondents' professional experience in each country. Respondents were asked: Overall, how would you rate your level of satisfaction with your experience as a practicing physician? As a practicing physician, how satisfied are you with the financial compensation for your work? As a practicing physician, how satisfied are you with the quality of medicine you have been able to practice? Separate answers were given for each system. Additional questions addressed the impact of cost containment measures and asked each physician to compare the two systems directly, using a single overall rating. For dual-experience physicians, an additional question asked for the reasons they had left their first country of practice. Respondents were invited to expand on their responses with additional narrative.

The 147 dual-experience physicians were of greatest interest; except where noted, all results were drawn from this group, which consisted of 75 Canadian physicians and 72 US physicians. Table 1 summarizes the reasons members of this group left their first country of practice; Table 2 compares the answers of the Canadian and US dual-experience physicians to the global satisfaction questions.

TABLE 1—Percentages of Dual-Experience Physicians Giving Reasons for Leaving Previous Country of Practice

Reason	Physicians Who Left the United States (n = 75)	Physicians Who Left Canada (n = 72)
Generally dissatisfied with system	25	43*
Unable to practice quality of medicine desired	13	29*
Unhappy with financial rewards	5	47**
Personal reason(s) unrelated to problems with the health care system		
In addition to one or more of above	32	28
Personal reason(s) only	48*	39

Note. Except for those who cited personal reasons only, respondents could select more than one reason.
*$P < .05$ (chi-square test); **$P < .001$ (chi-square test).

TABLE 2—Satisfaction of Dual-Experience Physicians with Canadian and US Health Care Systems

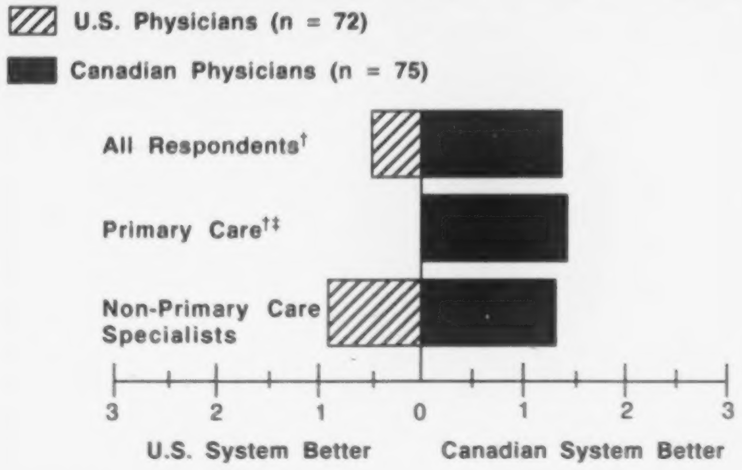
	Primary Care Physicians		Non–Primary Care Specialists		Total Sample	
	Canada (n = 37)	United States (n = 33)	Canada (n = 38)	United States (n = 39)	Canadian Physicians (n = 75)	US Physicians (n = 72)
Level of Satisfaction	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Overall, Canada	5.1 (1.4)**	4.0 (2.1)	5.5 (1.0)*	3.9 (1.9)	5.3 (1.3)*	4.0 (2.0)
Overall, United States	3.4 (1.5)	4.9 (1.5)*	4.3 (1.6)	5.1 (1.4)**	3.9 (1.6)	5.0 (1.5)*
With financial compensation, Canada	4.6 (1.7)*	3.3 (1.8)	4.5 (1.6)*	3.4 (1.7)	4.6 (1.6)*	3.4 (1.8)
With financial compensation, United States	4.7 (1.6)	5.4 (1.5)	5.0 (1.0)	5.6 (1.3)**	4.8 (1.3)	5.5 (1.3)*
With quality of medicine able to practice in Canada	5.4 (1.4)**	4.5 (2.0)	5.9 (1.0)*	4.1 (1.8)	5.6 (1.3)*	4.3 (1.9)
With quality of medicine able to practice in United States	4.3 (1.6)	5.3 (1.5)**	4.8 (1.7)	5.9 (0.9)*	4.6 (1.7)	5.6 (1.2)*

**Note.* Responses were made on a 7-point scale: 1 = completely dissatisfied, 4 = opinion neutral, 7 = completely satisfied.
*$P < .01$ (unpaired *t* test); **$P < .05$ (unpaired *t* test).

Physicians who had left Canada were significantly more likely than their US counterparts to express dissatisfaction with the health care system as a reason for leaving ($P < .05$; financial compensation, $P < .001$). Nearly half (48%) of those who had left the United States did so for strictly personal reasons unrelated to their experience with the US health care system (most commonly employment opportunities).

Physicians' expressions of satisfaction with their professional experience in their current country were significantly better than ratings of that country by physicians who had left ($P < .05$), with the exception of Canadian physicians' expressions of satisfaction with the financial rewards of both systems, which were essentially equal. Further dividing the Table 2 sample into those expressing dissatisfaction with the health care system and those giving only personal reasons (unrelated to the health care system) for switching countries showed that those with strictly personal reasons rated their initial country more highly than those expressing dissatisfaction.

Specialists in both countries indicated levels of satisfaction equal to or



† p<.01 (unpaired t-test, Canadian versus U.S. respondents)

‡ The value for U.S. primary care physicians was zero (a neutral rating)

Note. Values shown express a net absolute value calculated from original survey responses (see text for additional explanation).

FIGURE 1—Strength of support for current system among physicians with experience in both the United States and Canada.

higher than those of primary care physicians. US physicians, both primary care physicians and specialists, were more satisfied with their earning ability in the United States than with their previous earning ability in Canada. Canadian specialists were more satisfied with levels of compensation in the United States than in Canada, but to a lesser degree than their US counterparts, whereas Canadian primary care physicians expressed essentially equal satisfaction with their income in both countries.

Regarding the effect of cost containment measures on their ability to practice, both Canadian and US physicians indicated only a slight to moderately negative impact. There was no statistically significant difference between the two groups, except that Canadian specialists viewed US efforts at cost containment more negatively than did US specialists ($P < .05$).

Juxtaposed against the preceding data, the answers to the question "How would you rate the Canadian and US health systems in comparison to each other?" were unexpected. Each group again favored its current country, with the exception that US physicians who had left Canada for strictly personal reasons rated the Canadian system slightly better. The strength of response, however, was significantly different. For this question, responses given on a 7-point scale (1 = US system better, 7 = Canadian system better) were subtracted from the question's neutral rating of 4. The absolute net value of this calculation is seen in Figure 1, which demonstrates, in an overall sense, the strength of dual-experience physicians' rating of their current country over their previous one: Canadian physicians' rating of their own system was three times greater in strength than US physicians' rating of the US system ($P < .01$). Among all respondents, the Canadian physicians' rating of their current system was more than four times greater in strength than the US physicians' rating of the US system ($P < .01$).

It is useful to further divide the dual-experience group based on the time period in which practice experience occurred: those who, at least in part, practiced in both countries between 1970 and 1980 ($n = 112$) and those whose practice experience in both countries included years after 1980 ($n = 99$). The first group had the opportunity to experience the US Medicare and Medicaid programs begun in the mid-1960s as well as Canada's shift to its provincially based system, which was complete by 1972. (Most governmental programs for hospital coverage in Canada began in the late 1950s and were in place by the mid-1960s in all provinces; most governmental outpatient programs began in the mid-1960s and were in place in all provinces by 1972.) The second group had the chance to experience the more recent strains on the Canadian system as well as the institution of diagnosis-related groups in the United States.

When results from these subgroups were compared with those of the entire dual-experience group, only two important differences were seen. Among US physicians who left Canada sometime after 1970, mean values for overall satisfaction with the Canadian system as well as for quality of care and financial compensation in that system were somewhat lower than values in the entire group of US dual-experience physicians. In the subgroup of US physicians who had left Canada after 1980, a similar drop in mean values was seen regarding the level of compensation in Canada. All other fluctuations in mean values were minimal. Overall, the differences shown in Figure 1 were not substantially altered when we focused on physicians with more up-to-date experience in both systems.

Comment

As an important information source, physicians who have had direct professional experience in both Canada and the United States have been underutilized. These individuals have been "in the trenches" on both sides of the border and have seen how each system works on a day-to-day basis. Their input is a valuable addition to more theoretical analyses. In identifying every US-graduated Canadian physician and a similar-sized sample of Canadian-graduated US physicians, we sought to harness the real-life perspective of these unique groups.

These groups may not be representative of all Canadian or US physicians. In addition, the respondents were self-selected and may not be the same as nonrespondents. An analysis of respondents to the first and second mailings provides some information on this issue, since initial nonrespondents became part of the second group of respondents. We used simple t tests to compare all measures for these two groups. Only one of 16 comparisons was significant; this was approximately the number of differences expected on the basis of chance alone at $P = .05$. Respondents to the first mailing rated the US system significantly more highly than did second-mailing respondents. If such a difference is real, subsequent mailings to nonrespondents would only be expected to strengthen the results we obtained. Thus there is little reason, based on the data themselves, to suspect that if more opinions from nonrespondents were included, different conclusions would be reached.

The evolution of Canada's single-payer system was associated with protests from physician groups who feared governmental involvement. Those less enamored of the radical changes occurring in Canadian health care may have been more likely to leave when the opportunity arose. Thus, on the one hand, we expected the results summarized in Table 1: physicians who chose to leave Canada more commonly expressed dissatisfaction with the system as a reason for leaving than did their counterparts who left the United States. Yet levels of satisfaction with their current country were essentially equal: Canadian physicians were generally as satisfied with their professional experience as were US physicians, and they were reasonably satisfied with their financial rewards (Table 2). Further, notwithstanding the knowledge that their income would be greater in the United States, Canadian specialists in our sample expressed relative contentment with their practices as measured by levels of overall satisfaction and satisfaction with the quality of medicine they are able to practice. In both cases these indicators were equivalent to those of US specialists.

The most unexpected result was the relatively weak rating of the US system by US dual-experience physicians (Figure 1). We had expected a stronger rating of the US system by these US physicians as compared with the rating of the Canadian system by Canadian physicians, both because dissatisfaction with the health care system was more commonly expressed by physicians leaving Canada for the United States and because financial remuneration in the United States is greater. In this survey, the opposite proved the case. This result is not clearly explained by the global measures of satisfaction previously described, but it is partly accounted for by the fact that among physicians who moved from one country to the other for strictly personal reasons, current US physicians rated Canada slightly better while Canadian physicians strongly favored Canada. Although both US and Canadian physicians were reasonably and equally satisfied with their current practices, a compilation of solicited comments from the current survey offers some potential clues to explain the results summarized in Figure 1.

Three issues were most often raised in the respondents' comments: access to care, administrative responsibilities, and medical malpractice. These issues were consistent with previously acknowledged strong points within the Canadian system.[2,3] The need for better access to care in the United States, a widely discussed issue in the current literature,[18,19] was by far the most common concern expressed. It appeared that once physicians had experienced the positive effects of universal access (in Canada), it was difficult to accept their absence (in the United States). Universal access was seen as a major benefit not only to the patient but to the practitioner, who no longer needed to worry about the patient's ability to pay in determining a course of action.

The inefficient paperwork jungle common to US health care[20,21] was contrasted with the simplified administrative tasks of the Canadian system. Although the comments indicated that administrative requirements were increasing in Canada, Canada's provincially run, single-payer system remained extraordinarily simple compared with the US system. Although respondents were often concerned with the administrative overload in the United States, there was essentially no call for a single-payer system. Rather, the overall sentiment was in favor of maintaining a public-private insurance structure but with sufficient changes to decrease the administrative burden.

Medical malpractice was seen as a serious issue in both countries. The number of lawsuits has increased in both Canada and the United States. Canadian physicians expressed concern with the trend. Yet for dual-experience physicians the problems with medical malpractice in Canada paled in comparison with those in the United States. Even today, "Canadian physicians are only one fifth as likely to be sued for malpractice as their American counterparts."[22]

Nevertheless, it should be emphasized that physicians who left Canada were clearly more satisfied with their practices in the United States than in Canada. Their responses should not be construed as a call for the "Canadianization" of the US health care system. Rather, the message was that the United States should seek to learn from the successes of others. Instead of being the experimenter, the US system can take what has worked elsewhere and combine it with its own many strengths. Examples of how this might be done may come from Canada, from other countries,[23-25] or from within our own country.[26,27]

The weak rating of the US system by US dual-experience physicians can reasonably be interpreted as a call for a more careful analysis and probable reform of at least certain aspects of the US system, including issues of access, administrative burdens, and malpractice costs. The data gathered in this study, especially considering the generally conservative nature of physicians as a group, emphasize the need for change in the way health care is provided in the United States. ☐

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The Effects of a Natural Disaster on Child Behavior: Evidence for Posttraumatic Stress

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ABSTRACT

Objectives. A prospective study of children examined both before and after a flood disaster in Bangladesh is used to test the hypothesis that stressful events play a causal role in the development of behavioral disorders in children.

Methods. Six months before the disaster, structured measures of selected behavioral problems were made during an epidemiological study of disability among 2- to 9-year-old children. Five months after the disaster, a representative sample of 162 surviving children was reevaluated.

Results. Between the pre- and postflood assessments, the prevalence of aggressive behavior increased from zero to nearly 10%, and 45 of the 134 children who had bladder control before the flood (34%) developed enuresis.

Conclusions. These results help define what may be considered symptoms of posttraumatic distress in childhood; they also contribute to mounting evidence of the need to develop and evaluate interventions aimed at ameliorating the behavioral and psychological consequences of children's exposure to extreme and traumatic situations. (*Am J Public Health.* 1993;83:1549–1553)

Introduction

Stressful life events have long been suspected of causing behavioral and emotional disorders in children,[1,2] but their true causal role is difficult to distinguish in a controlled manner from effects.[3] Clearly defined events such as disasters can be distinguished from effects of a child's behavior because they occur independently of the behavior and because their timing in relation to the behavior is unambiguous. Unfortunately, methodological weaknesses[4] and the inconsistency between studies render the literature on children who have survived disasters,[1,5–14] wars,[1,15–18] and other acute events[19–21] inconclusive with regard to emotional and behavioral effects. Some studies report excess levels of anxiety, depression, and/or behavioral problems including aggression, enuresis, and eating and sleeping disorders,[1,5–7,9–11,15,18,19] while others report no apparent adverse effects on behavior or on psychological well-being.[8,12,14,16,17]

The present study used the strongest feasible design, a natural experiment, to investigate this issue. Natural experiments are prospective studies in which investigators can systematically observe the outcome of interest in a population both before and after a well-demarcated exposure or event.[22] Only two previously published studies of children exposed to severe events were able to use such a design; in one, 85 Israeli children (aged 10 to 11 years) were studied before and during war[18]; in the other, 64 American children (aged 4 years) were studied before and after a storm disaster.[7] In both studies, the prevalence of psychological distress symptoms increased significantly after the exposure compared with baseline. At the same time, neither study found evidence of a linear or dose-response relationship between the severity of the event for individual children and the probability of those children exhibiting symptoms.

The present study observed a larger number of children (162) and a wider age range (2 to 9 years) than the two previous prospective studies. In September 1988, 6 months after our international team completed a population-based study of child health and disability in Bangladesh, a flood disaster occurred. It was the most severe ever recorded in this densely populated country. More than three quarters of the land was submerged, much of it for 20 days or more. Throughout the country, millions of people were left homeless and more than 2000 died as an immediate consequence.[23] Five months after the flood (in February and March 1989), a representative sample of children evaluated during the initial survey was selected for reevaluation. We hypothesized that, despite maturation of the cohort, the prevalence of aggression, extreme shyness, and enuresis would be significantly higher after the flood than before.

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Editor's Note. See related editorial by Richman (p 1522) in this issue.

TABLE 1—Baseline Characteristics of Those Children Selected for Follow-Up and of Those Children Followed

	Children Selected for Follow-Up, % (n = 204)	Children Followed, % (n = 162)
Sex		
Boys	51.5	52.5
Girls	48.5	47.5
Age, y		
2	9.3	6.8
3	7.8	8.6
4	7.8	13.6
5	7.8	8.0
6	9.3	9.3
7	22.6	21.0
8	19.1	14.8
9	16.2	17.9
Disability status		
Not disabled	68.6	69.8
Disabled[a]	31.4	30.2
Cognitive disability	12.6	11.7
Motor disability	3.9	4.9
Hearing disability	11.9	13.0
Vision disability	2.9	3.1
Seizure disability	2.5	1.9

[a] Thirteen children selected for follow-up and seven children followed had multiple disabilities.

Methods

Study Sample

In March 1988, we completed a population-based study of neurodevelopmental disabilities in 2667 2- to 9-year-old children representative of Dhamrai, a rural, agricultural community north of Dhaka, Bangladesh. Households generally included nuclear and extended families; homes were built of reed and mud with earth flooring and one or two rooms. Half of the fathers and a quarter of the mothers had attended any level of primary school. All children who tested positive for disability on the Ten Questions screening instrument and a 10% random sample of those who tested negative were referred for standard clinical evaluations by a pediatrician and a psychologist, and a structured interview was conducted with a parent or guardian.[24–29] In all, 434 children were referred for evaluations and 64 were judged to have disabilities.

After the September 1988 flood, some of the children who were initially evaluated were selected for reevaluation, including all 64 with disabilities and a random sample (140) of the remainder (no more than one child per household). Of those, 2 children, 1 of whom had a disability, had died from diarrheal disease after the flood; moreover, 14 children with disabilities and 26 other children could not be traced (see Table 1). Thus, in February 1989, 162 children (49 disabled and 113 not disabled) were reevaluated.

Testing Instruments

During the postflood evaluation, the pediatricians asked the identical two questions about aggression and shyness that were asked before the flood (Appendix). However, the psychologists asked the question on sphincter control in different but comparable ways on the two occasions (Appendix).

The postflood psychological assessment added a child behavior screening scale administered to parents: the Richman Child Behavior Checklist[30] for children aged 3 to 6 years at follow-up and the Rutter Child Behavior Questionnaire[31] for those aged 7 to 10 years at follow-up. These brief and simple instruments are reliable and valid indicators of psychopathology and are widely used in culturally diverse populations.[30–32] In addition, the Self-Reporting Questionnaire[33] (a measure of psychological distress) was asked of the mother.

Each of these three scales was translated into Bangla, backtranslated, and revised appropriately. Internal consistency reliability coefficients (lower-bound estimates of reliability[34]) were good to excellent: 0.78 for the Richman checklist, 0.67 for the Rutter questionnaire, and 0.60 for the Self Reporting Questionnaire. Finally, a structured questionnaire measured the flood experiences of the community.

Statistical Analyses

The McNemar test[35,36] was used to test differences in the prevalence of problems before and after the disaster. T tests[37] were used to assess the differences in mean scores of postdisaster behavior scales between children reported to be aggressive after the flood and other children. Logistic regression[38] analyses were used to test for the effects of age, gender, disability, and severity of the disaster experiences on the dichotomous behavior outcomes (e.g., postdisaster onset of enuresis and aggressive behavior). Chi-square tests[36] were used to assess the significance of associations between the occurrence of two behavioral problems (aggression and enuresis). Lastly, the Taylor series method was used to calculate confidence intervals for the ratios of post- to preflood prevalence of incontinence.[39]

Results

The postflood survey documented major effects of the flood on the 162 households. Less than 10% had any warning of the flood. In more than a third, water rose to a level higher than an adult's waist, and more than half remained flooded after 10 days. Thirty-eight percent were badly damaged or destroyed. In half of the families, at least one member became seriously ill; in 7% a household member died, and in 4% the child was separated from the parents for more than a day.

Behavior

Before the flood, no child was reported to be very aggressive, and only one was reported to be extremely shy and withdrawn (Table 2). Twenty-seven (16.8%) had problems with sphincter control (bowel and/or bladder). After the flood, 16 children were newly reported to be very aggressive ($P < .0001$), shyness persisted in one affected child, and lack of sphincter control had increased from 16.8% to 40.4% ($P < .0001$). The increases in aggression and incontinence occurred among both children with and without disabilities and regardless of gender. (Although 11.8% of boys developed aggressive behavior compared with 7.8% of girls, this gender difference is not statistically significant in a logistic regression analysis.) Aggressive behavior increased at nearly every age. (Numbers are small, and specific age differences are not significant.)

Mean scores on the Richman checklist and the Rutter questionnaire (overall and on the conduct disorder subscale but not on the neurotic subscale) were significantly higher for children reported to be aggressive than for other children. The mean scores on the measure of psychological distress (the Self Reporting Questionnaire) were not significantly higher for mothers of children reported to be very aggressive than for mothers of other children.

For incontinence, the prevalence more than doubled (prevalence ratio 2.41, Table 2.) The increases were somewhat greater for children without disabilities than for those with disabilities, and for boys than for girls, but these increases are not statistically significant ($P = .57$ and $P = .50$, respectively, on logistic regression analysis). With no aggressive behavior observed at the preflood assessment, prevalence ratios for aggression could not be calculated.

The single question about sphincter control asked before the flood did not allow bladder control to be distinguished from bowel control. The postflood questions did allow this distinction. The increased prevalence of incontinence after the flood was owing entirely to new cases of enuresis. Among 134 children continent before the flood, none developed encopresis while 45 developed enuresis. All enuresis was nocturnal in children aged 3 to 6 years. (At 7 to 10 years, night and day wetting could not be distinguished.)

Incontinence

Before the flood, age-specific prevalence rates were as expected, with very high rates for 2- to 4-year-old children and much diminished prevalence thereafter (Figure 1). After the flood, the pattern differs from that expected. In children aged 2 and 3 years before the flood, prevalence declined less than expected, with maturation over a period of 11 months. In those aged 4 to 9 years, prevalence increased substantially.

Among younger children (3 to 8 years at follow-up), the risk of developing enuresis was high and relatively uniform (37% to 45%). At the oldest ages (9 to 10 years at follow-up), the risk was significantly lower (χ^2 vs all younger children = 6.47; P = .011) but still substantial (21%).

Twenty of 28 children wetting or soiling before the flood were still doing so after (with postflood data missing for 1 child). Another 45 previously continent children had "onset enuresis" at the second assessment, at a mean age of 6.3 years vs 2.9 years for those not yet toilet trained.

Aggression and Enuresis

We compared postflood development of aggression in three mutually exclusive groups with respect to continence: (1) those continent at both assessments (pre- and postflood), (2) those incontinent at the preflood evaluation; and (3) those continent before the flood and enuretic postflood (Table 3). Children incontinent before the flood had twice the prevalence of postflood aggressive behavior as other children (χ^2 = 2.20; P = .333, not significant).

Household experiences varied in terms of depth of water, degree of damage, illness, and loss. On logistic regression analyses, however, we found no relation between the severity of the flood experiences in individual children and the development of behavioral problems.

TABLE 2—Frequency of Selected Behavioral Problems Recorded during the Clinical Assessment before and after the Flood

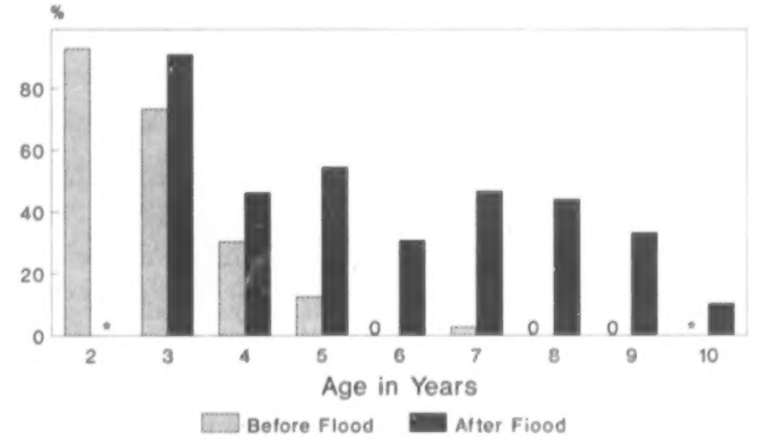
	Before		After			Prevalence Ratio (95% Confidence Interval)[b]
	No.	%	No.	%	P[a]	
Very aggressive toward others						
All children (n = 162)	0		16	9.9	<.0001	
Nondisabled children (n = 113)	0		10	8.8	.0020	
Disabled children (n = 49)	0		6	12.2	.0313	
Boys (n = 85)	0		10	11.8	.0020	
Girls (n = 77)	0		6	7.8	.0313	
Extremely shy/withdrawn						
All children (n = 162)	1	0.6	1	0.6	1.0000	1.00
Lack of sphincter control[c]						
All children (n = 161)[d]	27	16.8	65	40.4	<.0001	2.41 (1.63, 3.56)
Nondisabled children (n = 112)	18	16.1	48	42.9	<.0001	2.67 (1.21, 3.19)
Disabled children (n = 49)	9	18.4	17	34.7	.0768	1.89 (0.93, 3.82)
Boys (n = 85)	10	11.8	35	41.2	<.0001	3.50 (1.85, 6.61)
Girls (n = 76)	17	22.4	30	39.5	.0106	1.76 (1.07, 2.92)

[a] McNemar test of the significance of the difference between the proportions affected before and after the flood.

[b] Prevalence ratio for aggression cannot be calculated because of zero prevalence in the denominator (i.e., before the flood).

[c] The question asked before the flood referred to enuresis and/or encopresis. After the flood, separate questions were asked about enuresis and encopresis. The increased prevalence after the flood is owing solely to new cases of enuresis.

[d] Excluded is one child who was not fully toilet trained at baseline (a nondisabled girl, age 3) and who had missing information about enuresis and encopresis after the flood.



n=161; •no data for these 2 age groups

FIGURE 1—Prevalence of incontinence by age, before and after the flood.

Discussion

In accordance with our prior hypothesis and with previous studies, the prevalence of both aggressive behavior and enuresis in children rose sharply after exposure to major environmental stress. The observed increase in enuresis is particularly striking when one considers that the cohort had matured nearly 1 year between the first and second assessments.

Onset enuresis has long been considered a marker for anxiety, but experimental findings are rare. Control of the bladder during sleep is a subtle balancing act that requires either the child to wake to the stimulus of the full bladder (and get out of bed to void) or the sphincter to stay shut while the bladder is signaled to expand. For the sleeping child to lose a previously acquired skill, one need not invoke factors such as bladder size, depth of sleep, or cognition. Regression of bladder control such as that observed after the flood may imply autonomic system incoordination occurring at an age when the system is susceptible to being thrown off balance by an upsetting experience. As the child matures, the system stabilizes and regression is less likely. In Bangladesh, it appears that both regression and primary delay in sphincter control may have taken place. Previous studies have tended to associate regression rather than delay with emotional disturbance.[40-43]

Both increased aggression and onset enuresis were reported in Freud and Burl-

TABLE 3—Cross-Tabulation of Enuresis Status by Postflood Development of Aggressive Behavior

Behavior, %	Total	Prevalence of Postflood Aggressive Behavior, %
Continent at pre- and postflood evaluation	89	6.7[a]
Incontinent at preflood evaluation	28	14.3
Continent at preflood evaluation, enuretic at postflood evaluation	45	13.3
Total	162	9.9

[a] The lower prevalence of aggressive behavior in this group is not statistically different from that of the other two groups combined ($\chi^2 = 2.20$; $P = .333$).

ingham's[1] detailed observations of children in shelters (war nurseries) during the World War II bombings of London, and were interpreted as regressive behaviors provoked by children's separation from their parents and the overwhelming stresses of wartime. Similar observations of increases in both aggressive behavior and enuresis were made among 198 children discharged from a hospital burn unit compared with a comparison group of uninjured siblings.[44] Aggressive behavior and/or enuresis have also been reported in studies of children during the aftermath of a wide variety of disasters including an earthquake,[8] Australian bushfires,[9] a school disaster,[11] a flood disaster,[10] a lightning-strike disaster,[6] a tornado,[5] and a cyclone.[15] In addition to aggressive behavior and onset enuresis, many of these studies also reported increased anxiety, specific fears, and eating and sleep disorders.

One third of the sample of children selected for study in Bangladesh had disabilities at baseline; the remainder was a representative sample of the rural population under study. The increase in both aggression and enuresis observed after the flood was similar in the disabled and nondisabled samples. While the possibility remains that the flood could have affected children with specific types of disabilities differentially, the numbers with any one type of disability do not permit further evaluation.

The increases in aggression and enuresis occurred in both boys and girls. However, consistent with other descriptive epidemiological studies,[30,31,45,46] rates tended to be higher in boys.

The preflood rates in 7- to 9-year-old children both of aggressive behavior (none reported) and of enuresis (less than 2%) are lower in this population in Bangladesh than in European populations,[31,47–51] where prevalence rates for this age group range from 5% to 15% for aggressive behavior and from 6% to 10% for enuresis. In at least one study other than this one,[52] Asian children showed fewer behavioral problems than their European or American counterparts.

Consistent with the findings of the two previous prospective studies,[7,18] no dose response for individual children was observed between the severity of disaster experiences and behavior. One possible explanation for this is that an association was present but was confounded by unmeasured differences between households in resources that ameliorated the effects of the disaster. Another is that the disruption resulting from disasters and war is pervasive and communitywide. Thus, the relevant exposure is not the degree of household destruction and danger, but the overall disruption and terror experienced by the population as a whole.

One limitation of this study is that the follow-up was restricted to 5 months after the disaster, leaving uncertain the duration of aggressive behavior and enuresis. Another limitation is the absence of diagnostic evaluations before and after the flood that would have allowed us to determine whether exposure to the disaster resulted in an increased prevalence of actual psychopathology and/or of symptoms other than aggression and enuresis. From the significant associations between the single question on aggressive behavior and the Richman and Rutter behavior scales, we infer that this question, asked both before and after the disaster, appears to have validity. We may also infer that the aggression rating was not connected to stress in the mother since maternal psychological distress was not significantly higher for mothers of children reported to be very aggressive than for mothers of other children.

The results from this study are compatible with the hypothesis that children's exposure to stressful events may play a causal role in the development of psychiatric disorders. They point to the need for further research, particularly in populations at high risk for stressful events such as disasters, which cannot be confused with events precipitated by a child's own behavior. In addition, the mounting evidence to which this study contributes highlights the need to develop and evaluate interventions aimed at ameliorating the behavioral and psychological consequences of disasters and other extreme situations. □

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APPENDIX—Behavior Questions Asked during the Medical Assessment before and after the Flood:

Does he/she act very aggressively toward other people?
1. No 2. Yes

Does he/she act extremely withdrawn and shy?
1. No 2. Yes

Questions about sphincter control asked during the psychological assessment

A. Before the flood:
Does he/she have bowel and bladder control; is he/she toilet trained?
1. Yes, like others his/her age
2. Not consistent
3. No

B. After the flood:
In each set below, specify which applies to your child. For 3- to 6-year-olds (from the Richman Child Behavior Checklist)[30]:
1. Never wets at night
   Wets the bed up to once or twice a week
   Wets the bed three or more times a week
2. Never wets during the day
   Wets during the day once or twice a week
   Wets during the day three or more times a week
3. Completely bowel trained. Never dirties pants.
   Occasionally soils, up to once or twice a week.
   Soils pants 3 or more times a week.

For 7- to 10-year-olds (from the Rutter Child Behavior Questionnaire)[31]:
1. Wets his or her pants:
   Never in the last year
   Less often than once per month
   At least once per month
   At least once per week
2. Soils him/herself or loses control of bowels:
   Never in the last year
   Less often than once per month
   At least once per month
   At least once per week

Water Cost and Availability: Key Determinants of Family Hygiene in a Peruvian Shantytown

ABSTRACT

Objectives. This study was conducted to determine whether poor hygiene practices are owing to difficulty in getting enough water and/or to ignorance of sanitary principles.

Methods. In a water-scarce shantytown in Lima, Peru, we observed in 12-hour periods over 3 consecutive days the amount of water and soap used for personal and domestic activities in 53 families and the frequency with which direct fecal contamination of hands was interrupted by washing. We also surveyed women in a similar shantytown concerning their knowledge of hygiene to ascertain whether noncompliance was owing to ignorance.

Results. Three hundred fecal contamination events were registered, of which only 38 (13%) were interrupted by hand washing within 15 minutes. The mean 12-hour per capita amount of water and soap used by the families was low. More than 80% of the water stored by these families had fecal coliforms. Yet the level of knowledge concerning the importance of hand washing and other hygienic practices was high.

Conclusions. In water-scarce areas, sanitary education programs probably will not change hygiene practices. In these areas, an adequate supply of water is essential for good hygiene. (*Am J Public Health.* 1993; 83:1554–1558)

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Introduction

Hand washing is an effective means of interrupting fecal-oral transmission and decreasing the intrafamiliar spread of diarrheal disease pathogens such as shigella.[1–4] Poor hygiene practices may be due to ignorance of sanitary principles, high cost, scarcity of clean water, or distance from it.[5–8] When water is plentiful, programs that emphasize hygiene education increase personal sanitation practices and result in decreased rates of diarrhea.[9,10] However, educational messages may not succeed if adequate and convenient water supplies are not available.[11]

Water is a scarce resource in Lima shantytowns called *pueblo jovenes*.[12,13] To describe the effect of water scarcity on sanitary behavior, we used direct observation to determine hygienic practices in such a town.

Methods

Study Sites

The study was carried out in 1987, prior to the cholera epidemic, in two well-described periurban *pueblo jovenes* of Lima, Peru: Huáscar, Canto Grande, and Las Pampas de San Juan de Miraflores.[13,14]

Family Selection

Our study population consisted of families living in Canto Grande who were previously selected at random to participate in a longitudinal diarrhea study.[13,14] Fifty-three of these families, all with at least one child less than 3 years of age, were chosen for the current study. Although all families were impoverished, a skilled field-worker classified them into three ascending grades of wealth.

Differences in income (based on family expenditure data) in a *pueblo joven* are small, varying by less than $1500 per year between families. Seventeen families were selected with equal numbers in each wealth category to determine if that small difference in income affected water and soap consumption. No difference was found, and the remaining 36 families were selected from the randomly generated list without further stratification for wealth. There was no difference between the two groups in their mean socioeconomic status, family size, or water and soap use; therefore, both data sets were pooled and analyzed together.

Detailed In-House Methodology

Hygiene activities. Three consecutive days of 12-hour (7 AM to 7 PM) in-house observation were scheduled with mothers. During the observation period, the field-worker noted the activities of each family member, including preparation and consumption of food and water, defecation, handling of children's feces, and bathing and washing of hands. The field-workers engaged in small talk and avoided all comments concerning soap and water use. Children were asked

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whether they had defecated when they used the household borehole latrine or the nearby hillside. However, because adults were not similarly questioned about these activities, the defecations that were recorded were limited to those spontaneously mentioned by the adults or their children. Adult fecal contamination events are therefore probably underestimated. The type of water (fresh or reused) and soap (face, clothes, shampoo, or detergent) used by each family member was documented. The field-worker noted how often the mother observed her children drinking water that had not been boiled and permitted them to do so.

A contamination event was defined as a family member having just defecated or handled fecally contaminated material such as diapers. An interruption event was defined as the family member hand washing with water or with water and soap within 12 hours of the contamination event.

TABLE 1—Water and Soap Usage after Fecal Contamination: Percentage of Events,[a] by Family Role and Age

	Age, y				
After Contamination Events	0–2.0	2.1–5.0	5.1–10.0	>10.0[b]	Mothers
Defecation	(n = 74)	(n = 79)	(n = 42)	(n = 21)	(n = 9)
Hands not washed	88	99	90	71	89
Hands washed with					
Fresh water only	4		2.5		
Fresh water & soap	5	1		10	
Used water only	3		5	19	11
Used water & soap			2.5		
Touching stools	(n = 1)	(n = 3)	(n = 7)	(n = 10)	(n = 54)
Hands not washed	100	33	100	80	76
Hands washed with					
Fresh water only				10	7
Fresh water & soap				10	2
Used water only		67			15
Used water & soap					

[a] Based on events reported during 3 days of 12-hour observation periods.
[b] >10-year-old group does not include mothers.

Total water and soap use. The field-worker observed whether water obtained from the storage tank was boiled before it was drunk. She also noted how much water was used for washing dishes, food, and laundry, and for cleaning house. To facilitate the measurement of water, mothers were provided with a 1-L graduated pitcher. The field-worker weighed all soap at the beginning and end of each 12-hour observation period and noted the type of soap (but not the number of grams) used for each activity. Other household staples were weighed at the same time in order not to call attention to the measurement of the soap.

Water bacteriology. Quality of water stored outside the house was tested in 44 of the 53 Canto Grande families. Samples of 100 mL in sterile bottles were taken from the household cement tank (n = 35) or metal cylinder (n = 9). Fecal contamination of the water was determined by the presence of presumptive coliforms, heterotrophic plate counts,[15] and viable counts of *Aeromonas* and *Vibrio cholerae* sero group non-01. Counts of *Aeromonas* and *Vibrio* species were performed as previously described.[16–19]

Water attitudes and beliefs survey. We also surveyed 107 randomly selected families living in Las Pampas de San Juan to document their knowledge regarding the use of water, hand washing, and bathing. This *pueblo joven,* although different from Canto Grande, is socioeconomically similar.[13] The survey identified the mothers' perceptions of the health risks of not washing hands after fecal contamination and of drinking water that had not been boiled. Mothers were also asked whether water should be stored covered and, if so, why, and whether they drank water that was not boiled. They were also asked at what age and how often babies should be bathed.

Statistical Analysis

Activities were analyzed by age and sex and presented in frequency tables. We followed contamination events over time, using survival curves to determine rates and time intervals of the interruption of fecal-hand contamination. Life tables were used to examine, first, the duration between contamination and hand washing and, second, the duration between uninterrupted contamination and an episode of transmission. These curves were based on the following assumptions: (1) fecal contamination persisted if uninterrupted for at least a 12-hour period; and (2) handwashing, whether with soap or with water alone, stopped fecal transmission.[1] Handwashing that occurred within 15 minutes of a fecal contamination event was considered to be a purposeful interruption. Interruption after this time was defined as unintentional.

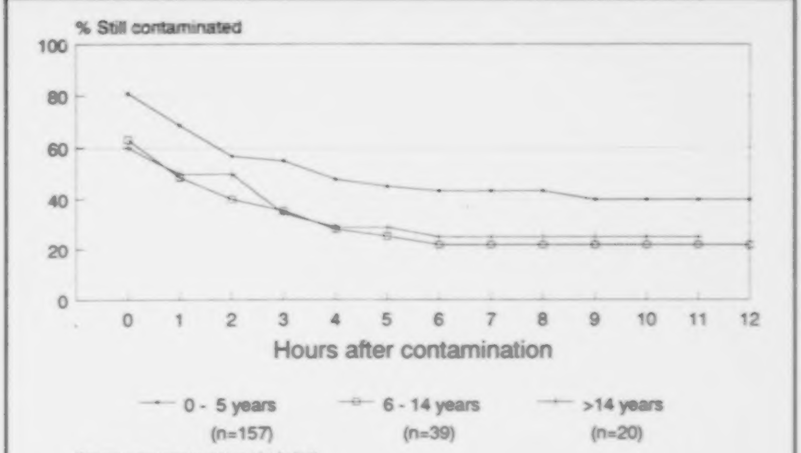
Mean daily soap and water consumption was tabulated, and the variances for each day were compared for homogeneity using Bartlett's test.[20] Pearson's correlation coefficients and linear stepwise regressions for the per capita amounts of water and soap used over 3 days were performed with the following variables: the field-worker's socioeconomic evaluation of the families, a housing quality scale (the concordance between the field-worker's scale and a previously described housing quality scale was good, McNemar test),[20] and the mother's and father's education. We also examined the correlation between the percentage of uninterrupted fecal contamination events by each mother and the above variables, as well as the total amount of water and soap used.

Plate counts, fecal coliforms, and individual and combined *Aeromonas* and *Vibrio* counts were tabulated, and linear regressions were run with the socioeconomic and total water and soap usage variables described above.

Results

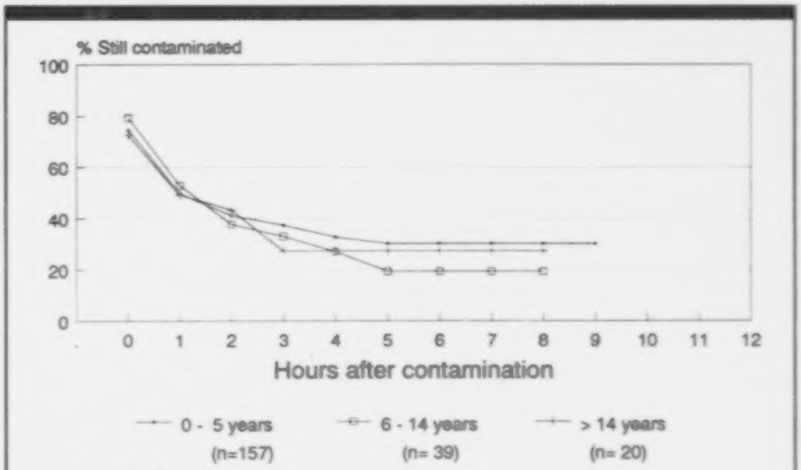
Contamination and Transmission Events

Family hygienic practices were observed in 53 Canto Grande families for a total of 1872 hours. There were 300 fecal contamination events registered, of which only 38 (13%) were interrupted by hand washing within 15 minutes (Table 1). There were significantly fewer contamination events interrupted in children under 10 years of age than in family members over 10 years of age (odds ratio [OR] = 0.275, 95% confidence interval [CI] = 0.13, 0.588). Soap was used in less than one half (10/38) of the intentionally interrupted events in both age groups. No socioeconomic or demographic characteristics identified which individuals interrupted fecal transmission (using a step-



Seventy six events are not included because of missing ages.

FIGURE 1—Interruption of fecal contamination by hand washing in 216 events.



In 76 events no birth date was available.

FIGURE 2—Transmission of fecal material from hands to food or water in 216 events.

wise regression model). However, the percentage of mothers' events that were interrupted after fecal contamination had occurred was significantly associated with the total amount of water used by the family ($r = .42$; $P < .05$). Also, the percentage of times that mothers washed their hands prior to eating or preparing food was associated with the total grams of soap used ($r = .42$; $P < .01$) and the fieldworker's economic evaluation of the family ($r = .57$; $P < .001$).

There were 3593 eating, preparing, and serving events observed, of which only 834 (23%) were preceded by hand washing within 15 minutes. The younger age group showed a significantly lower number of these events preceded by hand washing than did individuals over 10 years old (OR = 0.41, 95% CI = 0.34, 0.48). Soap was used significantly less often with hand washing before eating or handling food than after defecating (OR = 0.15, 95% CI = 0.07, 0.31). Soap use was not noted in 12 events.

Survival curves showed that most of the contamination episodes were uninterrupted during the first several hours of observation (Figure 1). Within an hour, more than 20% of individuals with contaminated fingers handled food, thus permitting the potential transfer of enteropathogens to other individuals (Figure 2). More than 25% of all contamination events were not interrupted. Moreover, 70% of contamination events became a transmission event.

Water and Soap Usage Patterns

The amount of water, as well as of soap, used by the family during the three 12-hour periods of observation did not vary significantly over the 3 days. The mean 12-hour per capita amount of water and soap used in the 53 families (mean family size was 5) was extremely low (8.8 +/− 3.8 L of water and 8.6 +/− 6.0 g of soap). About half of the water and nearly all of the soap (in the form of either detergent or laundry soap) was used for washing clothes (Table 2). Less than 15% of the total water was used for bathing and hand washing. Fewer than half (16/39) of the children 0 to 2 years of age and one fourth (12/48) of the 2- to 5-year-olds were bathed at least once during the 3 days of observation.

Most (87%) of the drinking water was consumed after boiling (normally as teas). Not only was more unboiled water drunk by older children but mothers permitted older children to consume such water and observed them doing so significantly more often ($\chi^2 = 11.6$; $P = .003$) than they did younger children (see Table 3).

Hand washing infrequently occurred with face soap, laundry soap, or detergent (Table 1). During the 3-day observation period, four families did not have any type of soap available for 1 of 3 days.

Socioeconomic factors and water usage. There was a weak but statistically significant association between total water used and mothers' education ($r = .3$; $P < .05$). Socioeconomic variables were not associated with total soap use. However, there was a significant association between the amount of total soap and total water used ($r = .66$; $P < .001$).

Water bacteriology. Ninety-five percent (42/44) of the houses sampled had a heterotrophic plate count of more than 500 colony-forming units (CFU)/mL, the standard for acceptable potable water.[15] More than three quarters of the 44 water samples had presumptive fecal coliforms present (Table 4).

In addition, half the families had *Aeromonas* species and almost one third had non-01 *Vibrio cholerae* isolated from their water. *V. cholerae* and *Aeromonas* species counts did not correlate with fecal coliforms counts.

There was no association between the fecal coliform count and either socioeconomic characteristics or quantity of water and soap used during the 12-hour observation period.

Comparative water supply and costs. Families used an average of 58 L of water

TABLE 2—Mean 12-Hour Water and Soap Use in Canto Grande Families (n = 53)

	Mean	Standard Deviation
Water use, L		
Personal hygiene	7.7	7.3
Washing clothes	21.4	28.7
Washing raw foods	5.0	5.0
Cooking foods	6.9	4.0
Washing dishes/ utensils	10.3	16.3
Cleaning house	0.9	1.9
Boiling water to drink	3.9	2.6
Drinking unboiled water	0.6	0.9
Total	56.2	36.5
Soap type, g		
Face soap	2.0	3.4
Shampoo	2.7	5.8
Clothes bar soap	20.7	37.9
Detergent	29.8	48.9
Total	53.6	55.3

TABLE 3—Consumption of Unboiled Water (%), by Age of Child, y

	0–2.0 (n = 26)	2.1–5.0 (n = 64)	5.1–10 (n = 94)
Mother saw child drink unboiled water	38	44	67
Mother did not see child drink unboiled water	62	56	33

per 12 daylight hours. Assuming that an additional 25% of the total water used during the day is used at night, about 75 L a day of water are used per day per family, 10 times less than the amount used by the average Peruvian family with in-house water connections (1134 L) (Webb S. Waterborne disease in Peru. World Bank; August 1992, unpublished working paper).

In Canto Grande, water costs about $0.38 per 378 L. This price is nearly five times what it costs a family with in-house connections ($0.08 per 378 L). Both the *pueblo joven* and the middle-class families spend approximately 2% of their monthly income on water ($2.22/$120.00 and $7.2/$500.00, respectively). However, whereas *pueblo joven* families receive small quantities of poor quality water, middle-class families enjoy large quantities of relatively good quality water.

Mothers' attitudes and behavior on hygienic issues. Nearly all the 107 mothers surveyed in Las Pampas de San Juan were aware that hand washing and boiling of water were important methods of blocking the transmission of infection (Table 5). However, this knowledge did not affect the type of water that mothers reported drinking. Thirty-seven (35%) mothers said that a portion of the water they consumed was not boiled. Yet these mothers knew that boiling water killed germs as often as did the mothers who drank only boiled water. About 90% of mothers knew that contamination of hands with feces produced disease.

TABLE 4—Enteropathogenic Contamination of Water Stored in Cisterns or Cylinders in Canto Grande Families (n = 44)

	Total Houses	
	No.	%
Presumptive fecal coliform count[a]		
0	9	20
1	17	39
2	18	41
Aeromonas sp.[b]		
0	22	50
1	16	36
2	6	14
Non-01-*Vibrio cholera*[b]		
0	31	70
1	10	23
2	3	7

Note. CFU = colony-forming units.

[a] 0 = negative; 1 = <3 log CFU/100 mL; 2 = >3 log CFU/100 mL.

[b] 0 = negative; 1 = <3 log CFU/mL; 2 = >3 log CFU/mL. Presumptive fecal coliforms per 100 mL.

TABLE 5—Mothers' Knowledge and Attitudes about Water Use in San Juan de Miraflores (n = 107)

	No.	%
Does contamination of hands with feces produce illness?		
No	12	11
Yes: intestinal infections	54	51
skin infections	13	12
no specific reason given	20	19
No response/don't know	8	7
Does bathing a child produce illness?		
No	86	80
Yes, respiratory infections	17	16
Don't know	4	4
Do you drink unboiled water?		
No	70	65
Yes: prefers the taste	22	21
when in a hurry	12	11
Don't know, no response	3	3
Is boiled water better than unboiled water?		
No: vitamins are lost	1	1
unboiled tastes better	1	1
Yes	105	98
Why is it better to drink boiled water?		
Protects from germs	98	93
Taste or don't know	7	7
Is it better to have water covered?		
No, it is the same as uncovered	3	3
Yes	103	96
Don't know	1	1

Discussion

This study used direct observation because it is the most accurate method for documenting family hygienic behavior.[13,21] The duration between fecal contamination events and their interruption by hand washing was analyzed using survival curves to analyze hygienic behaviors that are censored at varying times.

Water quantity has been considered an important factor in diarrheal disease prevention.[8] We found that families that used more total water interrupted fecal contamination by hand washing more often. Interruption of fecal contamination was not influenced by mother's education or by family socioeconomic characteristics.

In Bangladesh, where water is plentiful, sanitary education was effective in reducing the number of diarrheal episodes.[9,10] In Lima, where per capita levels of water are among the lowest reported,[22] the majority of *pueblo joven* mothers knew that fecally contaminated hands transmitted disease, yet few washed their hands after obvious fecal contamination. Although knowledge about sanitation practices was adequate, hygienic practices were poor, presumably because water is scarce.

In addition to being insufficient in quantity, the water is also lacking in quality since it is stored in easily contaminated uncovered or partially covered tanks or cylinders. The effect of contamination is somewhat mitigated since more than 85% of water is boiled before consumption.

However, based on the speed with which cholera spread through the *pueblo jovenes*, it would appear that the remaining 15% contamination is enough to effectively transmit disease.

In 1992, because of drought, water was more expensive and scarcer than it was in 1987 (personal communication, Dr Carmen Marin, AB PRISMA, Lima, Peru, July 10, 1993). During the 1992 cholera epidemic, there were widespread media messages about boiling water and washing hands. Yet in a 1992 study of water practices, the percentage of water not boiled before drinking and the number of episodes of fecal contamination not purposely interrupted were similar or slightly worse than what was found in our 1987 precholera study.

The detection of fecal coliforms is the standard routinely used to determine water quality.[15,22] Our data and others[17,22] suggest that counts of *Aeromonas* and *Vibrio* species may also be useful for monitoring the purity of drinking water. We and others found no association between coliform and *Aeromonas/Vibrio* counts.[17]

Lima's *pueblo jovenes* have one of the highest diarrheal rates reported: 10 episodes per year.[23] Our results suggest that providing increased information concerning hygiene without providing increased water probably will not result in better sanitation practices. In water-scarce communities, personal hygiene and possibly the number of diarrheal episodes would be improved by providing convenient, cheap, in-house water. For the same cost as they are paying now, in-house connections to a *pueblo joven* household would provide four to five times the volume of high-quality water as they are currently receiving. The money saved by reducing diarrheal episodes would eventually cover some or all of the installation costs. Costs can also be reduced if the community provides free labor and perhaps designs less orthodox and lower-cost systems.[24] In-house water connections would measurably improve the quality of life in the periurban marginal communities of Peru. □

Acknowledgments

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An Epidemic of Pesticide Poisoning in Nicaragua: Implications for Prevention in Developing Countries

Rob McConnell, MD, and Allan J. Hruska, MS

ABSTRACT

Objectives. The purpose of this study was to demonstrate the usefulness of the Northwestern Nicaraguan Ministry of Health surveillance system for detecting pesticide poisonings.

Methods. Cases were reported to the regional department of epidemiology through daily telephone reports and through monthly consolidated reports from each of the 18 health centers of the National Health Service. Reporting forms were also distributed to the four area hospitals.

Results. During June and July 1987, an epidemic of 548 pesticide poisonings was detected in northwestern Nicaragua. Seventy-seven percent of the poisonings were caused by carbofuran or methamidophos. Of the work-related cases (91% of reported poisonings), more than 80% occurred among maize farmers and on small to medium land holdings (fewer than 140 hectares). Nineteen percent of the work-related cases involved children under 16 years of age.

Conclusions. Unsafe working conditions such as manual application of pesticides and the use of backpack sprayers, the introduction of a hazardous powdered formulation of carbofuran highly restricted in the developed world, and agricultural subsidies that encouraged the use of hazardous pesticides all contributed to the epidemic. (*Am J Public Health.* 1993;83:1559–1562)

Introduction

Pesticide poisoning is a major public health problem in the Third World. Recent worldwide estimates suggest that each year, there are 3 million severe, acute pesticide poisonings and 220 000 deaths.[1] Most of the poisonings and 99% of the deaths are believed to occur in developing countries, although the Third World accounts for only 25% of total worldwide pesticide consumption.[2] Although food-borne outbreaks of severe poisoning, which often result in hospitalization, are reported commonly in the Third World,[3] there are remarkably few well-documented examples of epidemics of worker poisoning. Unfortunately, most available data in Latin America reflect hospital-based (severe) poisonings, because there seldom exists the capability to organize surveillance systems outside hospitals.

In the early 1980s, Nicaragua implemented a series of social reforms, including redistribution of agricultural land to small farmers, and universal health coverage was provided through the new unified National Health Service, which emphasized primary care services and preventive public health.[4] Surveillance systems for preventable diseases were established, including a regional pesticide poisoning registry for the 632 000 people living in the principal agricultural area on the northern Pacific Coastal plain.[5] Reporting forms were distributed to the four hospitals and the 18 health centers of the National Health Service, which was the exclusive source of medical care for most of the rural population in this region. The reporting of pesticide poisonings increased immediately (see Figure 1).

The usefulness of the system was demonstrated in an epidemic of poisonings in June and July 1987 (see Figure 2). Two peaks in frequency of poisoning occurred in two distinct seasons: June and July, corresponding to the planting of food crops (especially maize), and September through December, corresponding to the cultivation of cotton. However, the number of poisonings involving food crops increased disproportionately in 1987. Information collected through the surveillance system made it possible to identify and characterize the epidemic.

Methods

Cases were reported to the regional department of epidemiology through daily telephone reports and through monthly consolidated reports of all reportable diseases from each health center of the National Health Service. Name, age, location where poisoning occurred, reporting center, and (sometimes) job title and pesticide used were available through these reports. These reports were used to direct the regional ministry's outbreak control unit, which conducted investigations and on-site worker training in safe use of pesticides and screened workers for cholinesterase depression (a test for subclinical overexposure to toxic organophosphate insecticides). The regional department of epidemiology also provided follow-up cholinesterase tests for overexposed or poisoned workers referred by the health centers. Treating clinicians were almost exclusively physicians who had been trained in the diagnosis and treatment of acute poisoning in a course run by

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the Ministry of Health. A summary of descriptive statistics from the registry was distributed quarterly to each clinic in the region. Field observations of pesticide applications were made during the period of the epidemic.

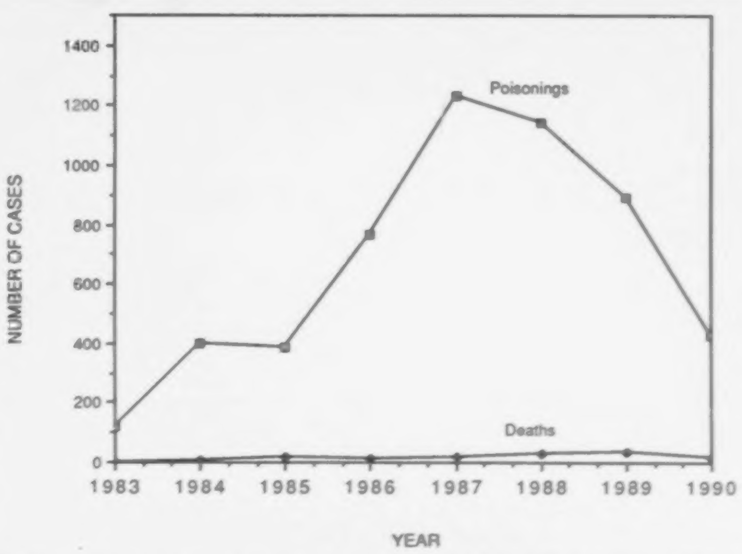

FIGURE 1—Pesticide poisonings and deaths reported to the Nicaraguan Ministry of Health Region II registry, 1983 through 1990.

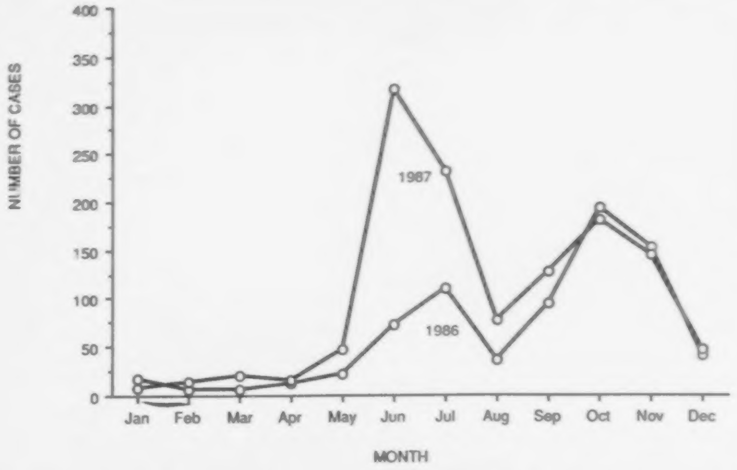

FIGURE 2—Monthly reports of pesticide poisonings reported to the Nicaraguan Ministry of Health Region II registry, 1986 through 1987.

TABLE 1—Principal Pesticides Responsible for Occupational Poisonings: June–July 1986 and June–July 1987

Pesticide	Total Cases, % 1986 (n = 181)	Total Cases, % 1987 (n = 351)	Change in No. of Reported Poisonings, 1986–1987	Proportionate Morbidity Ratio Based on 1986 Standard (95% Confidence Interval)[14]
Carbofuran	26	46	+131	173 (159, 186)
Methamidophos	39	31	+39	80 (73, 88)
Chlorpyrifos	13	6	−5	40 (32, 51)
Methyl parathion	. . .	2	. . .	. . . . . .

Note. Reports with missing data are not included.

Results

The epidemic of June and July 1987 was not the result of improved reporting, because the increase was confined to this 2-month period (Figure 2). Of the 548 cases reported (316 in June and 232 in July), 91% (368/404) were occupational, 8% involved other accidents, and 1% were suicide attempts. (Of the 548 responses to the question regarding type of poisoning (occupational or otherwise), 144 (26%) were left blank by the reporting health workers. In general, missing data were not included in the calculations presented.) The description of the epidemic is restricted to occupational poisonings. Of the four deaths, three were suicides and one was a nonoccupational accident. Three of the four deaths were caused by the insecticide methamidophos.

Of the occupationally exposed patients for whom sex was reported, 96% (353 of 368) were male. The mean age was 27 years, and 19% (71 of 366) of the patients were less than 16 years old, the minimum legally permissible age for working with pesticides in Nicaragua.[6] Forty-one percent (166 of 404) of occupational poisonings were relatively more severe occurrences reported from hospitals. Eighty-six percent (301 of 351) of the cases for which crop was indicated involved maize. Eighty-two percent (276 of 338) of the poisonings for which size of farm was identified occurred among workers on small and medium-sized farms (fewer than 140 hectares). Only 10% (35 of 338) and 8% (27 of 338) occurred among workers on large private farms and state farms (greater than 140 hectares), respectively.

The insecticides responsible for the epidemic were cholinesterase inhibitors. More than half of the poisonings involved a carbamate insecticide, and almost half involved an organophosphate. Two specific insecticides were most often implicated (see Table 1). Almost half of the poisonings involved the carbamate insecticide carbofuran (sold under the trade name Furadan), which at the time was imported from Mexico, and one third resulted from the organophosphate methamidophos, a peripheral neurotoxin[7] (sold in Nicaragua as Monitor, Filitox, Tamaron, and MTD). The increase in carbofuran poisonings from 1986 to 1987 accounted for the majority of the overall increase (in occupational poisonings for which the responsible pesticide was reported by the health worker). Thirty percent of the carbofuran poisonings for which the type of formulation was indicated reportedly involved powder, a formulation that is severely restricted in most of the developed world because of the easy absorbance by the respiratory tract. Most of the remainder of the absolute increase was accounted for by methamidophos, although the proportion of all poisonings caused by methamidophos decreased. Of note is that the number of poisonings involving chlorpyrifos decreased.

Discussion

The epidemic demonstrates the viability of a clinic-based comprehensive surveillance system in the Third World and the value of this system in detecting, measuring, and, ultimately, alleviating outbreaks of pesticide poisoning. Contrary to the common conception that clinic-based surveillance is difficult in the Third World, the surveillance system functioned effectively because participating clinicians perceived the benefits that the clinics received from reporting: an outbreak control unit that responded to clinicians' requests, a training course designed to upgrade clinical skills in the treatment of pesticide poisoning, a referral center for follow-up of poisoned workers, and periodic feedback on patterns of pesticide poisoning in the region. The system could be implemented because rural access to health care was almost universal under Nicaragua's National Health Service.

Surveillance is a powerful tool for demonstrating the public health impact of pesticides in a way that impresses the public. Based on a crude estimate that two thirds of poisonings are not reported, 3602 cases of medically treated poisoning may have occurred in this region in 1987 (or 5.9/1000, based on 1234 reported cases for the year and a total population of 632 000). (A survey of 633 agricultural workers identified 24 who reported that they had been treated for poisoning.[8] Only 8 of these cases were actually reported to the surveillance system.) Further review of data on childhood poisoning in this region revealed an alarming increase in the proportion (as well as in the absolute number) of reported poisonings among children, from 12.7% of all poisonings in 1984 to 17.1% in 1987 ($\chi^2 = 3.24$, for slope; $P = .072$).[9] During the mid-1980s, young men who traditionally applied pesticides were away at war. Because pesticide application is not a job that requires extensive physical strength and because of the shortage of adult labor, children were used in this activity.

Health authorities declared a regional health emergency 3 weeks into the epidemic, a media campaign was begun to advise workers in less hazardous handling of carbofuran, and outbreak control and preventive education were expanded through the clinic network. Proposals emerged to substitute less hazardous imports for more hazardous ones, and there has been no repetition of the dumping of carbofuran powder on the Nicaraguan market.

However, the long-term impact of the epidemic in reducing pesticide poisoning in Nicaragua, as well as the ability of the health sector, by itself, to reduce poisoning in the Third World in general, is questionable. The reason is that the health sector can offer little more to workers than health education and the promotion of personal protective equipment as a solution to the problem of endemic pesticide poisoning, a solution actively promoted by the pesticide industry.[10] The reasons for pesticide poisoning in the Third World (and for this epidemic) often include economic factors outside of the control of the health care system. For example, health effects are seldom considered anywhere in the Third World in developing policy on pesticide subsidies, although subsidies that encourage pesticide use are common.[11] During 1987, pesticides were supplied almost free of charge to most Nicaraguan farmers through favorable exchange rates and negative real interest rates.[12,13] As a result of subsidies, farmers increased the number of applications in maize, the crop involved in most of the poisonings, from 4.2 to 6.3 per season. In addition, in 1987, the price at which maize could be sold was deregulated by the government from its previously fixed price. Production of maize increased in the region from 12.1 million kg to 49.1 million kg between 1986 and 1987 (unpublished data, Ministry of Agricultural Development and Agrarian Reform 1988), and demand increased for highly toxic carbofuran and methamidophos for control of maize pests. The weight of imported carbofuran active ingredients increased by more than 50% from 1986 to 1987. In addition, importation of chlorpyrifos ceased, in part because chlorpyrifos was more expensive than either methamidophos or carbofuran. Since there was a shortage of chlorpyrifos, which is considerably less acutely toxic than carbofuran, workers substituted carbofuran for chlorpyrifos.

Working conditions typical of the developing world contributed to the epidemic. In the developed world, carbofuran granules are applied by tractor, entailing little exposure to the applicator. In Nicaragua, carbofuran was mixed with urea, which facilitated dermal absorption, and applied by hand. As noted above, carbofuran also was available in a powder formulation in 1987. In the developed world, acutely toxic liquid pesticides such as methamidophos are applied by planes or tractor-drawn boom sprayers. Among small farmers in the developing world, they are applied by backpack sprayers, and leakage is common. Most occupational pesticide poisonings in this region occur during backpack application. In addition, most farmers received no training in the hazards of pesticides because there were essentially no agricultural extension services such as those in developed countries, and protective rubber gloves and respirators, had they been available, cannot be worn by farmers working in the tropical sun in a humid climate where ambient temperatures reach 40°C. Finally, like most Third World countries, Nicaragua still does not require that imported pesticides be registered in the country of origin, and pesticides banned or restricted in the country of origin are used widely.

This epidemic suggests that the importation of acutely toxic pesticides, pesticide subsidies, and the overuse of pesticides under primitive working conditions are major causes of poisoning in developing countries. The number of poisonings decreased only slightly in 1988, the year after the well-publicized epidemic (see Figure 1). A further decline in 1990 probably resulted from markedly reduced subsidies for pesticides purchased by small farmers (although it may reflect greater underreporting as a result of decreased funding for health). Although surveillance is necessary to focus attention on the problem of pesticide poisoning, recent experience in reducing pesticide use suggests that policies promoting nonchemical alternatives to pest control may be the most appropriate solution to the problem of poisoning in Nicaragua and elsewhere in the Third World.[15] □

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Dr Feliciano Pacheco Anton, chief of occupational health for the Nicaraguan Ministry of

Health in Region II, established the poisoning surveillance system in 1984 and has since promoted its use. Without his work, this epidemic would have gone unnoticed. The surveillance system also was supported by the Nicaraguan Ministry of Health (Region II), CARE Nicaragua, and the American Friends Service Committee.

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Fatal Occupational Injury Rates: Quebec, 1981 through 1988

ABSTRACT

Objectives. The purpose of the study was to estimate the death rates from occupational injuries in the province of Quebec for the period 1981 through 1988.

Methods. Worker's compensation files were used to ascertain numbers of deaths, which were used as the numerators in figuring the rates (it was estimated that these files reported 83% of the true number of deaths among men). Annual average estimates of the labor force were used as denominators.

Results. From 1981 through 1988, compensation was awarded for 1227 fatal work injuries. Among men (96% of the victims), rates declined from 1981 to 1988 (from 12.7 to 8.1 per 100 000); women's rates were stable (≤1.0 per 100 000). Compared with men, women had excess mortality from violent acts. Motor vehicle crashes accounted for 36% of all fatal injuries in 1984 and 1985 and declined thereafter. Fatal injury rates in forestry and mining rose to a 1987 maximum of 67.6 per 100 000. The construction sector had the largest number of deaths, despite a decline in rates from 1981 to 1988 (from 27.8 to 15.9 per 100 000).

Conclusions. Except for construction and agriculture, reported fatal occupational injury rates in Quebec were similar to those in the United States. Motor vehicle crashes, falls, violent acts, and farming-related injuries were the most frequent causes of death. (*Am J Public Health.* 1993;83:1563–1566)

Michel Rossignol, MD, MSc, and Marc Pineault, BSc

Introduction

Comparison of fatal occupational injury rates is difficult, largely because of differences in definitions and methods for estimating the numerators and denominators of these rates. The discrepancies between some of the rates reported for the United States suggest that case ascertainment remains an important limitation in our understanding of fatal occupational injuries. The National Safety Council, the Bureau of Labor Statistics, Bell et al., and Baker et al. reported, respectively, annual crude rates of 13, 7, and 9.1 (1980) and 7 (1978) per 100 000.[1–4]

The objective of this study was to estimate the death rates from occupational injuries in the Province of Quebec for the period 1981 through 1988 by sex, age, and industrial sector.

Methods

Numerators

In Quebec, any person who hires another to do a job for a salary or other form of benefit must register with the Quebec Worker's Compensation Board to insure the employee in case of occupational injury or disease. Most employees in Quebec, with the exception of employees under federal administration, military personnel, and most of the self-employed, are covered under this scheme. For use as the numerator of death rates in this study, we counted all cases in which compensation was paid to the relatives of a worker, aged 15 years or older, who died from unintentional or intentional injuries (except suicide) sustained while working or at the work site from January 1, 1981, through December 31, 1988.

Reporting to the Quebec Worker's Compensation Board protects the employer against lawsuits in the compensation system. Fatal injuries were determined by the Board to be occupational if the victim was pursuing a gainful activity at the time of the event or the injuries were inflicted on the employer's premises (including parking lots). Deaths from occupational diseases and exertional heart attacks, which are sometimes coded as occupational injuries by the Board, were excluded from this study.

Denominators

The annual average labor force estimates of Statistics Canada for Quebec, 1981 through 1988, were used as denominators.[5] These averages were based on monthly interview surveys of families randomly selected to be representative of the population of Quebec (response rates over 95%). Excluded from these estimates were persons younger than 15 years of age, full-time military personnel, most inhabitants of Indian reserves, and institutionalized persons. Statistics Canada provided estimates of the sampling error in the form of standard deviations for the number of employed persons by age, sex, and industrial sector. In this study, we used data on industrial sector only for 1984 and following years, because the classification system used before 1984 was not compatible with the current one.

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TABLE 1—Compensated Fatal Occupational Injury Rates for Men, by Age, Quebec, 1981 through 1988

Age Category	Compensation Coverage, %[b]	Average Annual Rate per 100 000	n	95% Confidence Interval[a]
<20 y	81	6.6	52	4.9, 8.8
20–24 y	82	8.3	131	7.0, 9.9
25–34 y	93	8.7	329	7.8, 9.7
35–44 y	91	8.7	274	7.7, 9.8
45–54 y	78	10.0	221	8.7, 11.5
55+ y	66	11.4	173	8.9, 14.6
Total		9.1	1180	8.4, 9.8

Note. In calculating these rates, the numerator was taken from Quebec Worker's Compensation Board figures; the denominator was from Statistics Canada annual averages of the employed population.

[a] Confidence intervals are based on the Poisson distribution and take into account the sampling error for the denominators.

[b] Compensation coverages reported elsewhere.[8]

TABLE 2—Compensated Fatal Occupational Injury Rates for Men, by Industrial Sector, Quebec, 1984 through 1988

Sector (Compensation Coverage)[a]	Rate per 100 000 (n)				
	1984	1985	1986	1987	1988
Primary[b] (92%)	17.4 (8)	29.3 (12)	50.0 (20)	67.6 (25)	52.8 (19)
Construction (90%)	27.8 (30)	21.5 (23)	17.9 (22)	13.4 (19)	15.9 (25)
Transportation, communication, and utilities[c] (77%)	12.5 (20)	13.5 (23)	13.6 (22)	14.5 (25)	13.1 (23)
Public administration[d] (96%)	16.0 (20)	15.0 (1[illegible])	15.7 (19)	12.2 (16)	7.7 (9)
Agriculture (46%)	9.4 (5)	5.0 (3)	10.9 (6)	13.2 (7)	6.3 (3)
Wholesale and retail (86%)	5.3 (15)	5.5 (16)	5.8 (18)	6.3 (19)	5.3 (16)
Manufacturing (95%)	4.0 (16)	5.2 (20)	3.6 (14)	3.3 (13)	5.1 (22)
Finance, insurance (undetermined)	9.5 (6)	3.1 (2)	7.8 (5)	0.0 (0)	0.0 (0)
Services (98%)	2.5 (9)	4.2 (16)	2.4 (9)	4.8 (18)	5.3 (21)
Missing	1	1	3	1	1

Note. In calculating these rates, the numerator was taken from Quebec Worker's Compensation Board figures; the denominator was taken from Statistics Canada annual averages of the employed population. The Canadian classification of industrial sectors based on the 1981 revision was first used in 1984.

[a] Compensation coverages reported elsewhere.[8]

[b] Primary sector other than agriculture: fishing, forestry, and mining.

[c] Utilities include gas and electricity.

[d] Provincial and municipal, including protection and police services.

Statistical Analysis

Death rates were computed for each year from 1981 through 1988 by age and sex, and from 1984 through 1988 by industrial sector. Age and sex standardization of the rates was performed with the 1981 population structure as the reference.[6] The adjusted rates were almost identical to the crude rates; therefore, the unadjusted rates are presented throughout this report. Years of potential life lost were computed for each death by calculating the difference between the age at death and 65.[7]

Measure of Error

Confidence intervals (95%) were computed for each rate, based on the Poisson distribution and taking into account the sampling error of the denominator provided by Statistics Canada.[5] To account in part for the exclusion of the self-employed from the compensation system data (numerator), compensation coverages had been previously calculated by age, sex, and industrial sector from a combination of compensation files and coroner's death certificates for the years 1987 and 1988.[8] It was estimated that the compensation coverage of fatal occupational injuries was 83% for men and 100% for women. Compensation coverages are reported throughout this paper for greater accuracy in interpreting the rates.

Results

From 1981 through 1988, the Board compensated 1227 fatal injuries. Rates among men (96% of the total) declined from 1981 (12.7 per 100 000; 95% confidence interval [CI] = 11.1, 14.6) to 1984 (8.2 per 100 000; 95% CI = 6.9, 9.8) and remained stable thereafter. Because compensated cases represented roughly 83% of the true number of deaths among men, the rates would actually be closer to 15.3 (1981) and 9.9 (1984) per 100 000.[8] Among women, rates ranged from 0.2 to 0.8 per 100 000; 53% of the fatal injuries were related to motor vehicle crashes. Although they represented only 4% (n = 47) of all fatal injuries, women were victims of 14% of the fatal violent acts that occurred during the period studied.

Motor vehicle crashes accounted for 25% (n = 54) of all occupational injury deaths in 1981, increasing to 36% in 1984 (n = 49) and 1985 (n = 52) and dropping thereafter to a low of 21% (n = 30) in 1988. Two causes of fatal injuries showed regular increases in proportion between 1981 and 1988: falls to a lower level (an increase from 8% to 15%) and electrocutions (an increase from 4% to 6%) (chi-square; $p < 0.01$).

Fatal occupational injury rates increased with age, reaching 11.4 per 100 000 in the group aged 55 years and older (Table 1). The lower compensation coverage in that age group (66%) would bring the rate to 17.3 per 100 000. It was also these workers who showed the most dramatic drop (53%) in rates between 1981 (15.6 per 100 000) and 1988 (7.4 per 100 000). Fatal injuries in the older age group were associated in higher proportions with "being struck by" objects (27%) and with falls (17%). The 35- through 44-year-olds had the highest proportion of motor vehicle crash–related fatalities (38%). In terms of years of productive life lost, the 25- through 34-year-old age group came first, with a total of 11 337, followed by the 35- through 44-year-old group (6847) and the group aged 20 through 24 years (5481).

The only industrial sector that showed a regular increase in fatal injury rates, and also the one with the highest rates, was the primary sector (fishing, mining, and forestry) (Table 2). The rates in this sector peaked in 1987 at 67.6 per 100 000, nearly a fourfold increase over 1984 rates. This increase was explained by an increase in fatal injuries in the forestry industry, in which the number of deaths rose from 8 in 1984 to 25 in 1987 and 19 in 1988.

The construction sector, on the other hand, showed a steady 43% decrease between the years 1984 and 1988. It had the highest number of deaths (119, or 18% of the total from 1984 through 1988) and the largest proportions of deaths from falls (30%) and electrocutions (10%). Transportation, communications, and public utilities were second for number of deaths (113 deaths, or 17% of the total from 1984 through 1988), almost half of which (46%) were related to motor vehicle crashes. Considering the low compensation coverage in this sector (77%), this sector would account for the largest number of deaths, and rates would be closer to 16.2 (1984) and 18.8 (1987) per 100 000.

Agricultural death rates were low, but because of the low compensation coverage (46%), the true rates would be twice those shown in Table 2.

Discussion

Information on cases of occupational fatal injuries is often incomplete in the United States, where differences of up to 300% have been found in rates reported by different sources of information.[9] Death certificates have been the information source of choice because more deaths could be identified from death certificates than from surveys or inspection reports.[10] The Quebec Worker's Compensation Board information system on fatal occupational injuries was found to provide more accurate information than death certificates in Quebec except for older workers and those in transportation and agriculture, where compensation coverages were found to be low.[8]

The specification of sex when reporting fatal occupational injury rates is a point that deserves special attention. Because men accounted for 96% of all fatal injuries but for only 60% of the work force in Quebec, the rates for both sexes combined underestimate the real situation for men almost by half. For example, our men's rate for the year 1988 was 8.1 per 100 000, but the rate for both sexes combined was only 4.8 per 100 000. The National Safety Council's work-related accidental death rates did not mention sex, so it is assumed that both sexes were combined in the Council's estimations by year and industry.[1] For any comparison with these rates to be fair, one must multiply the denominator of the rate by the proportion of men in the working population. If the proportion of men in the US work force is 60%, as it is in Quebec, the 1988 death rate for men in the United States would be not 9 per 100 000, the rate reported by the National Security Council, but 15 per 100 000, which is almost twice as high as the rate of 8.1 we found for men in Quebec.

In two different studies, homicides accounted for 53%[11] and 39%[3] of women's fatal occupational injuries. These proportions are difficult to compare with ours (17%) because our data included only 47 deaths among women. Nevertheless, there is enough consistency to justify specific prevention programs aimed at protecting women who are in direct contact with the public.

In the 8 years prior to 1981, a 35% decrease in death rates from occupational injuries was reported for Quebec.[12] The secular downward evolution could be partially explained by the gradual introduction of safer working conditions and practices. However, this pattern was not sustained through the 1980s with rates that remained stable after 1983. After 1983, for instance, the 50% reduction in fatal injury rates in the construction sector was counterbalanced by a threefold increase in the primary sector. The large contribution of forestry to this increase was similar to what was reported in British Columbia.[13]

The rising proportion of motor vehicle crashes as occupational fatalities is a concern that Baker et al.[4] pointed out more than 10 years ago when they urged the need for preventive measures addressed to professional drivers. Little has been achieved in Quebec to improve the situation. The rate of truck crashes (of trucks weighing more than 4.5 metric tons) causing any type of injuries increased from 18.0 per 1000 vehicles in 1982 to 22.8 in 1986, and for each death of a truck occupant, 4.6 additional deaths occurred among nonoccupants.[14] The increasing weight and length and number of trailers pulled have been implicated as factors influencing crash involvement.[15] Three sectors accounted for 62% of all fatal motor vehicle crashes: transportation, wholesale and retail, and services. Energetic action must be taken to address this No. 1 occupational cause of death.

Another important finding was the higher fatal injury rates among workers aged 55 and older. The pattern was more pronounced than that reported by Baker et al.[4] Falls caused more deaths among these workers than in any other age group, and the proportion of deaths due to falls increased between the years 1981 and 1988. Factors that influence older persons' stability and balance, including antihypertensive and antihypoglycemic drugs, could be of importance in the workplace. Such a hypothesis deserves further attention.

Between 1981 and 1988, 19 fatal injuries were compensated in the farming sector. The compensation coverage rate of only 15% would bring the actual number of deaths to around 146, second only to motor transport operation (for which there were 202 compensated, or 264 estimated, deaths). Our rates for agriculture cannot be compared directly with those reported in the United States, where fishing and forestry are included in the agricultural sector. In addition, gross errors in estimating the number of deaths in agriculture have been reported.[16,17]

In Quebec, as in the United States, half of the fatal injuries in farming were related to farm tractors.[4,15] Goodman et al. estimated the annual tractor-related fatality rate for males to be 23.6 per 100 000 male farm residents in the state of Georgia for the years 1971 through 1981.[18] This figure is almost as high as our highest estimation of the death rate in the agricultural sector (28.7 per 100 000). The application of rollover protection structures in farm tractors has been examined by Kelsey et al.[19] and Karlson et al.[20] This hazard has remained largely unrecognized in Quebec because of an insufficiency of data outside the compensation statistics. The public health authorities must be alerted to the seriousness of the situation so that they can formulate new priorities for the agricultural sector. ☐

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Modern Contraception Use in Ethiopia: Does Involving Husbands Make a Difference?

Almaz Terefe, BSc, MPH, and Charles P. Larson, MD, MSc, FRCPC

ABSTRACT

Objectives. This study was undertaken to determine the relative efficacy of home visitation with and without husband participation on the use of modern contraception in Ethiopia.

Methods. A randomized field trial of a family planning education intervention using home visitation with and without husband participation was conducted in Addis Ababa, Ethiopia, from August 1990 to December 1991 and included a 12-month postintervention follow-up. A total of 266 experimental and 261 control subjects were entered, of whom 91.7% and 88.9%, respectively, were followed through 12 months.

Results. A greater proportion of couples in the experimental group were practicing modern contraception at 2 months (25% vs 15%) and 12 months (33% vs 17%) following the home visit intervention. By 12 months following the home visits, experimental subjects were less likely to have defaulted and more likely to have started using modern contraception following an initial delay.

Conclusions. The inclusion of husbands in family planning programs will result in relevant increases in the use of modern contraception. However, there exists an important "sleeper" effect to the education intervention, reflected by a delay of greater than 2 months in the initiation of modern contraception for most couples. (*Am J Public Health.* 1993; 83:1567–1571)

Introduction

Rapid population growth, which in many instances far outstrips economic growth and environmental sustainability, is the reality in most developing countries of sub-Saharan Africa.[1–3] Within this region, annual population growth rates over the past 2 decades have continued to increase, and the contraception prevalence rate has remained under 10%.[1,2]

In Ethiopia the overall contraception prevalence rate among women of childbearing age (15 to 49 years) is less than 2%, and the crude birth rate is estimated to be 49 per 1000 population.[1] Most women in Ethiopia marry by the age of 15, and less than 6% remain single by the age of 24.[4] On average, Ethiopian wives experience seven pregnancies during their lifetime, each pregnancy carrying about a 1% risk of death.[1,3,5,6] These figures are associated with an annual rate of population growth of approximately 3%.[1,2] Applying the lower end of national fertility projections, the current Ethiopian population of 50 million is expected to reach 90 million by 2010 and 165 million by 2035.

The aim of the program was to initiate and sustain modern contraceptive use among married couples. Because the limited research on male roles in Ethiopia and sub-Saharan Africa has consistently found that decisions regarding family size and contraception are dominated by husbands, who expect to have large families,[7–12] this field trial was undertaken to determine what effect involving husbands in a community-based, home visitation, health education program would have on the use of modern contraception in Ethiopia.

Methods

Study Design

This was an experimental, randomized field trial comparing the relative effectiveness of a modern contraception educational intervention program in Ethiopia with and without husband participation. The general architecture of the study and enrollment are found in Figure 1. The interventions were carried out between August 1990 and January 1991, and modern contraceptive use was verified at 2 and 12 months following intervention.

The study was conducted in the semi-urban, peripheral Kotebe District, one of 18 districts in Addis Ababa. Kotebe is located at about 12 kilometers northeast of the city center. Approximately 80% of its population of 43 000 is urban. The source population for the field trial was any urban Kotebe female resident between the ages of 15 and 49 years who was married and living with her husband. It was estimated that there were approximately 1214 women eligible for this study residing within the 12 randomly selected zones. Excluded from eligibility were women currently using modern contraception, pregnant women, and women with a chronic physical or mental illness. Prior to this study, no family planning outreach program was or had been in existence.

Local, trained traditional birth attendants who were currently working in the district and had, on average, more than 10 years experience in the community were paired with a female interviewer having a 12th-grade education. The pairs were pro-

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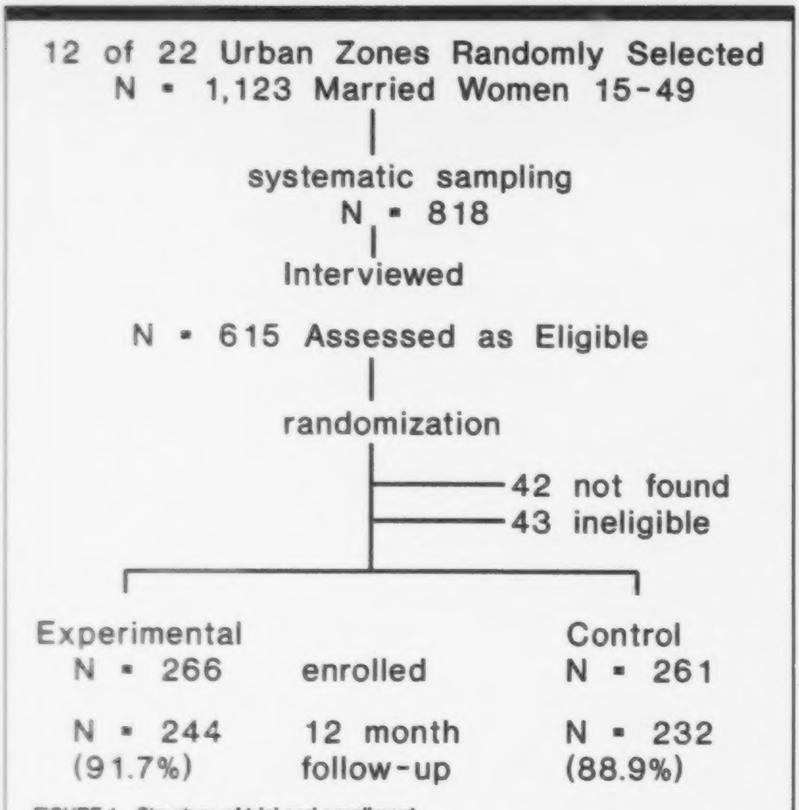

FIGURE 1—Structure of trial and enrollment.

vided with the names of married women of childbearing age who resided in their respective zones and were systematically selected on a 2:1 basis from a census list. The birth attendants identified these women, confirmed their eligibility for enrollment (203 of 818 were excluded), and arranged a date and time for a home visit. The interviewer completed a baseline questionnaire, which in all instances, was conducted with the wife only. The interviewers were unaware of the research objectives and group assignments. Following completion of the questionnaire, one of the principal investigators (AT) collected blocks of eight names and assigned them as control or experimental subjects based on random assignment schedules for each home visitor. At the time of the follow-up home visit, a further 88 subjects were excluded: 42 had moved or could not be found, 43 were ineligible (24 were pregnant, 13 postmenopausal, 6 on contraception), and 3 had husbands who refused the visit. The final enrollment figures were 261 control and 266 experimental subjects. There was no loss of subjects at the 2-month follow-up, but 29 control (11.1%) and 22 experimental (8.3%) subjects were lost to follow-up after 12 months.

Intervention

Eight female health assistants, accompanied by the traditional birth attendants involved in the initial contact, conducted the home visits. These health assistants were employed at the local district health station and were known to the community. They worked on this project in the early evenings and on weekends, which facilitated scheduling the husbands in the experimental group. The health assistants were trained to maintain an informal atmosphere and to permit spontaneous communication.

After briefly explaining the purpose of the study, the health assistants requested the consent of the participants. Next, they provided health education on family planning and modern contraceptive methods to either the wife alone (control group) or the wife and husband (experimental group). (The eight health assistants had an almost equal number of control and experimental subjects.) The sessions generally started with a discussion of the health of the family, which is a culturally acceptable manner in which to initiate a conversation. Questions on the woman's reproductive history were then used as the entry point into the actual family planning education. The content of the education focused on the advantages of family planning as a means of preventing unwanted pregnancy and birth, of spacing births, and of controlling family size. Health assistants discussed the advantages of birth spacing for the mother, children, and family with respect to both promotive and preventive aspects of health. Additionally they stressed the ill effects of a large family on all family members and on the nation as a whole. This was followed by an explanation of alternative contraceptive methods—the birth control pill, the intrauterine device (IUD), and the condom—and a discussion of the relative efficacy of modern contraception versus traditional methods.

A maximum of two visits were made. Couples intending to initiate modern contraception were allowed their choice of method and provided with the appropriate explanations and information about follow-up. The contraceptive method was provided at the conclusion of the home visit, if requested. This included either two cycles of birth control pills, two dozen condoms, or a copper-T IUD set to be brought to the local health center for insertion.

The hypothesis to be tested was as follows: those couples in which husband and wife receive family planning education in the home will have a significantly higher rate of modern contraceptive use at 2 and 12 months following the intervention than those couples in which the wife alone receives such education ($P < .05$, two-sided).

Measurement

Baseline sociodemographic and reproductive histories as well as knowledge about and attitudes toward modern contraception were obtained prior to randomized assignment and a home visit. Initiation of contraception was recorded as yes on the basis of stated intent following the home visit. At 2 and 12 months, the use of modern contraception was verified on the basis of current birth control pill use and refills, condom refills, or proof of IUD insertion. In all instances, this information was obtained from the wife.

Analysis

All questionnaires were checked by one of the principal investigators for accuracy, and the data were coded. Data were entered, edited, and analyzed using EPI-INFO version 5.01B (USD, Inc., Stone Mountain, Ga).

Results

Ninety-five percent of the study group were Orthodox Christians, and 85%

TABLE 1—Characteristics of Experimental and Control Subjects

	Experimental Group	Control Group
	Mean (1SD)	Mean (1SD)
Age, y		
Wife	30.8 (6.7)	31.5 (6.6)
Husband	39.8 (8.2)	41.0 (8.9)
Education, y		
Wife	5.2 (3.8)	5.2 (3.9)
Husband	7.3 (4.1)	7.3 (4.4)
Siblings, no.		
Wife*	5.0 (2.6)	5.6 (2.9)
Husband	4.5 (2.8)	4.5 (2.8)
Deliveries, no.	3.9 (2.4)	4.0 (2.5)
Living children, no.		
Male	2.0 (1.5)	1.8 (1.4)
Female	1.6 (1.3)	1.8 (1.6)
Age of last child, mo	40.1 (47.8)	42.0 (51.6)
Desired number of children	4.0 (1.2)	4.0 (1.7)

*P < .05, t test.

TABLE 2—Verification of Modern Contraception (MC) Use at 2- and 12-Months Follow-Up

	At 2 Months			At 12 Months		
	MC Use	No.	%	MC Use	No.	%
Experimental subjects (n = 244)	Yes	63	25.8	Yes	40	16.4
				No	23	9.4[a]
	No	181	74.2	Yes	40	16.4[b]
				No	141	57.8
Control subjects (n = 232)	Yes	39	16.8	Yes	13	5.6
				No	26	11.2[a]
	No	193	83.2	Yes	27	11.6[b]
				No	166	71.6

[a] Defaulters.
[b] Delayed starters.

of the women were housewives. The language of origin in two thirds of the participants was Amharic while that of the rest was mostly Oromigna. Two thirds of the husbands were government employees, which includes local factory workers. There were no between-group differences in these characteristics. Complete follow-up through 12 months was achieved in 91.7% of the experimental and 88.9% of the control subjects.

Table 1 summarizes the between-group comparison of demographic and reproductive histories. There were no significant differences between control and experimental subjects found at enrollment, except that control group women had a slightly higher number of siblings (*P* < .05). The level of education of 70% of the women was 6th grade or below, while 70% of the men had completed 5th grade or higher. Husbands in this study were also older than their wives. The number of women having one to two children, three to four children, and five or more children ranged between 25% and 30% for each category and was evenly and uniformly distributed across both groups. Only 6.6% of the women had no living children.

There were no significant group differences in family planning knowledge or attitudes. The majority of the women (65%) wished to have four children. Fifteen percent of the women had not heard of modern contraceptive methods while about 40% knew of only one such method: mainly the birth control pill. Husbands were generally supportive of the need for family planning (57% and 69% in control and experimental subjects, respectively).

Following the home visit intervention, 47.0% (n = 125) of the experimental versus 33.0% (n = 86) of the control women decided to start using modern contraception (relative risk [RR] = 1.42, 95% confidence interval [CI] = 1.15, 1.76). In more than 90% of cases, the birth control pill was chosen. At 2 months following the home visit intervention, it was confirmed that approximately one-half of all couples who had stated their intention to initiate modern contraception were not using it. The practice of contraception at 2 months was verified in only 24.7% (n = 66) experimental and 15.3% (n = 40) control subjects (RR = 1.61, 95% CI = 1.13, 2.30). This analysis was further stratified by the presence or absence of husband support for family planning. Relative risk estimates and 95% confidence intervals remained above 1 and favored the experimental subjects with and without husband support. No significant interaction was found (Woolf's χ^2 0.14, *P* = .71).

Table 2 summarizes the modern contraceptive practices of those subjects who were successfully followed through 12 months after home visitation. From these figures, one can subgroup subjects into those who practiced modern contraception throughout the year (yes at 2 and 12 months), those who defaulted by 12 months (yes at 2, no at 12 months), those who delayed starting (no at 2, yes at 12 months), and those who never used it (no at 2 and 12 months). Experimental subjects were less likely to have defaulted from modern contraceptive use by 12 months (RR = 0.55, 95% CI = 0.37, 0.81) and more likely to have delayed starting it (RR = 1.58, 95% CI = 1.01, 2.46). At 12 months, twice as many experimental couples were using modern contraception as were control subjects (RR = 1.90, 95% CI = 1.36, 2.66). Overall, 25.2% of couples were using it at 12 months, and the majority of these (55.8%) initiated the practice 2 or more months after the home visit intervention.

Discussion

This randomized field trial of family planning education in the home with or without husband participation has demonstrated that, as hypothesized, providing a family planning educational intervention program in the home to the husband and wife significantly improves modern contraception use up to 12 months following the intervention. Usage as measured by early or late initiation, overall use at 12 months, and default rates was better in all instances among couples with husband participation than among those couples without husband participation. Given the favorable quality of the randomization, it is concluded that the differences can be attributed to husband involvement in the intervention program and have not been confounded by demographic, reproductive, or knowledge and attitude disparities between the two study groups.

Several investigators have found that Ethiopian and East African husbands expect to have large families and thus play a dominant role in a couple's decision to initiate modern contraception.[7-12] Given that most Ethiopian women will not initiate contraception without their husband's knowledge, a husband's disapproval can be expected to be a major deterrent to use. Unfortunately, favorable husband attitudes do not appear to be sufficient. For example, among the couples enrolled in this study, none of whom were practicing modern contraception at the outset, more than 60% of husbands supported the need for family planning. This high baseline level of husband support for family planning was unexpected and may explain the generally successful response to the two interventions. It may be that the husbands were providing the expected answer out of respect for the interviewer. Similar unpublished findings of high support but low practice have been found in the north-central Ethiopian district of Yifatna Timuga. While husbands may acknowledge the need for family planning, practice tends to be influenced by the high levels of misinformation regarding the side effects of modern contraception, particularly oral contraceptives.[7] This includes fears of sterility, arthritis, loss of weight or strength, and skin changes.

Of particular interest is the finding that most of the women initiated modern contraceptive use more than 2 months following the intervention. This delayed or "sleeper" effect was first described 40 years ago by Hovland and Weiss,[13] who attributed the delay in communication effect to the low credibility of the source of information. Over time, the inhibiting influence of the source diminishes and the message leads to change. It has been assumed, but unconfirmed, that health assistants and trained traditional birth attendants enjoy a relatively high status in Ethiopian communities; this may not be the case. Alternatively, the delays observed may be explained in terms of the time required to undergo a change in attitude and the degree of personal commitment required. Given that the use of modern contraception is contrary to past practices and familial expectations, the home visit may have shifted couples from a position of uncertainty or ambivalence to one of an acknowledged, positive desire to initiate modern contraception. Such a change in attitude and, subsequently, in actual practice is a process that, in a large subset of couples, may unfold over several weeks. The delays identified in this study suggest that family planning intervention programs should interpret early results cautiously.

Is the intervention package offered in this trial applicable to and realistic for other Ethiopian and sub-Saharan communities? To answer this question, three elements of the intervention require consideration: home visitation, the visitor, and the educational content. Home visiting is a labor-intensive activity that requires competent organizational skills at the district level and reliable transportation facilities. A maximum of two visits—and in most cases, only one visit—was provided. Four to six women or couples were seen in a half-day schedule. The equivalent of one full-time health assistant can be expected to serve from 1500 to 2000 couples per year in an urban community. In a rural setting, these numbers would be reduced owing to travel time. The large majority of the couples visited were not regular health institution attenders and, in the absence of home visiting, were unlikely to have benefited from an institution-based program. Without a community outreach component such as home visitation, family planning services would miss the large majority of their target population.

In this study, husband participation was high. Although there were a few instances in which the husband refused to complete the health education session, the vast majority were tolerant and available as scheduled. Several factors may explain this high rate of husband compliance. First, the visits were carried out by health workers well known to the community. These workers shared a common cultural and social background with the couples they visited and were aware of how to approach husbands in an acceptable and appropriate manner. Second, the educational message was ordered to respond first of all to the couples' main concerns or perceived barriers to use. Third, at the time this intervention was carried out, the stability of the government was very much in question. Thus, for security reasons, people tended to return home and stay at home after working hours. This situation probably facilitated the task of scheduling husband participation.

The interventions were provided by health assistants and trained traditional birth attendants who were currently working in the district following a brief period of training. This level of health professional is found throughout Ethiopia and most of Africa. The content of the intervention was based on the educational outline described; as mentioned, however, this content was modified according to the couple's family planning knowledge and attitudes, with which the birth attendants and health assistants were familiar. Given appropriate supervision and integration into existing health services, the interventions provided are considered applicable to any urban and probably most rural settings in Ethiopia.

At 12 months following the intervention, nearly one quarter of all subjects were using some form of modern contraception. In a district where the baseline contraception prevalence rate was 2%, the rise to 17%, even without husband involvement, is a strong endorsement of home visitation. With the inclusion of husbands, the program's impact on the use of modern contraception nearly doubled. If these results can be repeated in other settings, the benefits would seem to justify the personnel inputs. The training and supervision requirements are modest and applicable to districts where a health management system is in place and functional. Based on the study's findings, the development and evaluation of alternative models of home visitation and husband involvement that include evaluation of the intervention elements and costs in relation to its benefits is recommended.

This investigation does not take into account the interaction of multiple factors influencing the desire to have children—in particular, cultural factors that can vary widely between regions, districts, and even communities. Warwick[14] and others have cautioned against grand conclusions based on single studies, and we concur. Involvement of husbands must be linked to local realities and responsive to the expressed desires of communities. The intervention described in this study was developed following extensive consultation with the community and the national family planning program. Furthermore, we used existing resources and housed the program within the local health institutions. This provides, at best, a broad framework upon which to design similar family planning programs that involve men in contraception and constructively expand their family planning responsibilities. ☐

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1994 National Committee for Clinical Laboratory Standards Annual Meeting

The theme of the 1994 National Committee for Clinical Laboratory Standards (NCCLS) annual meeting, "A View From the Bridge: Pressures on Laboratory Practice," takes a step back to observe clinical laboratory practice from different points of view. The meeting will be held at the San Diego Princess Resort, San Diego, Calif, March 24 through 26, 1994; it will provide an opportunity for constituencies from government, industry, and the professions to meet and discuss important issues affecting the clinical laboratory testing community.

A keynote address by a news media representative will open the meeting, with discussion on various media topics currently affecting clinical laboratory testing. This will be followed by a plenary session offering public relations, regulatory, and consumer points of view on the use and abuse of clinical laboratory news. The first two concurrent symposia will focus on domestic issues regarding requirements for technological progress and near-patient testing. The second set of symposia will tackle international cooperation on requirements for technological progress and noninvasive and minimally invasive testing. Slated to close the meeting is a discussion on the future, specifically healthcare reform and how it will affect clinical laboratory testing, both operationally and economically. All sessions will be conducted in a roundtable format for ease of discussion, and an expanded poster session will be held.

The annual meeting education program will begin on Friday afternoon, March 25, and continue all day Saturday, March 26. The program will cover timely topics in clinical laboratory testing related to NCCLS standards and guidelines.

NCCLS is an interdisciplinary, nonprofit organization that promotes the development and use of voluntary consensus standards within the clinical laboratory community. NCCLS membership comprises medical library professional associations, agencies of the federal and state governments, manufacturers of laboratory equipment and products, and individual laboratories and health care institutions. For more information, contact Donald W. Thompson, NCCLS, 771 E Lancaster Ave, Villanova, PA 19085; tel (215) 525-2435; fax (215) 527-8399.

Low Birthweight and Infant Mortality in Puerto Rico

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ABSTRACT

Objectives. The purpose of this study was to quantify the relative contributions of maternal age, education, marital status, hospital of birth, and use of prenatal care to the high incidence of low birthweight and infant mortality in Puerto Rico.

Methods. An analysis was conducted of 257 537 live births that occurred from 1986 through 1989 among Puerto Rico residents and the 3373 corresponding infant deaths. Binomial multiple regression models were used to calculate the adjusted population attributable risks for each variable.

Results. Our estimates indicate that approximately 6 of every 10 infant deaths on the island are potentially preventable if low birthweight were eradicated, regardless of other associated factors. Eliminating risks associated with sociodemographic and socioeconomic factors (including hospital of birth) would potentially decrease the incidence of low birthweight in Puerto Rico by one third. Specifically, the elimination of risks associated with the socioeconomic disadvantage of women delivering in public hospitals alone would potentially decrease Puerto Rico's low birthweight incidence by 28%, regardless of other factors considered in our study.

Conclusions. Efforts to prevent low birthweight and infant mortality in Puerto Rico should focus on reducing the gap between the private and public sectors. (*Am J Public Health.* 1993;83:1572–1576)

Introduction

Puerto Ricans in both the continental United States and Puerto Rico have the highest incidence of low birthweight and infant mortality of all Hispanic groups in the United States.[1] In 1990, the low-birthweight rate in Puerto Rico was 9.1%, compared with 7.0% for the United States as a whole.[2,3] In the same year, the infant mortality rate in Puerto Rico was 13.4 per 1000 live births, compared with the overall US rate of 9.1.[2,4]

In previous studies, investigators have implicated increased birthweight-specific neonatal mortality risks,[1,5] smoking,[6] and inadequate prenatal care[7] as contributors to adverse pregnancy outcomes in Puerto Rico; however, no previous study has quantified the relative contributions of sociodemographic and socioeconomic factors to the high incidence of low birthweight and infant mortality on the island.

This study had two objectives: to assess the relative contributions of maternal age, marital status, maternal education, hospital of birth, and use of prenatal care to the incidence of low birthweight in Puerto Rico, and to assess the relative independent contributions of those same factors to the incidence of infant mortality after accounting for the effect of birthweight. The ultimate goal of the study was to provide public health policymakers in Puerto Rico with accurate information that can guide the design and implementation of prevention strategies to reduce the high incidence of low birthweight and infant mortality.

Methods

From 1986 through 1989, 258 354 live births occurred among Puerto Rico residents.[2] Infant death certificates from 1986 through 1990 were matched to their corresponding birth certificates. Fewer than 2% of these certificates remained unmatched, thus, valid data for the variables under study were available for 257 537 live births and the 3373 corresponding infant deaths.

We defined infant death as the death of a newborn before the end of the first year of life; infant birthweight as low birthweight (< 2500 g) or normal birthweight (≥ 2500 g); maternal age as less than 20 years or 20 years or more; marital status as unmarried (including consensual unions) or married; maternal education as less than 12 or 12 or more years of formal education; hospital of birth as public or private; and prenatal care as none or some prenatal care documented in the birth certificate.

We used the generalized linear model technique to fit a binomial multiple regression model to the data.[8] After considering all possible combinations of main effects of the variables under study, we selected and compared four hierarchical models. Two of these models (models 1a and 1b) included the combined effect of all exposure variables on birthweight. Model 1a included only the main effects, and model

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1b added all statistically significant ($P < .05$) second-order interactions. The log-likelihood ratios[9] were 51.6 ($df = 26$, $P < .01$) for model 1a and 32.9 ($df = 23$, $P = .08$) for model 1b. The other two models (models 2a and 2b) added birthweight to the exposure variables and considered infant death as the outcome. Model 2a included only the main effects, and model 2b added all statistically significant ($P < .05$) second-order interactions. The log-likelihood ratios were 105.8 ($df = 57$, $P < .01$) for model 2a and 57.6 ($df = 52$, $P = .27$) for model 2b.

Finally, we estimated the population attributable risk for each variable after adjusting for all other variables included in model 1b and model 2b.[10] The population attributable risk is the proportion of a health outcome potentially prevented if the risk associated with a given factor is eradicated from the population after the data have been adjusted for all other risk factors. For instance, to estimate the population attributable risk of low birthweight for unmarried mothers—adjusting for the simultaneous effects of age, education, hospital of birth, and prenatal care (model 1b)—we calculated the *individual* risks according to the binomial regression model and assumed that each mother was married. We totaled these individual risks to calculate the *expected number* of low-birthweight infants if all mothers had been married and compared that expected number with the actual number of low-birthweight infants observed in the population. The following formula was used:

$$\text{Population Attributable Risk} = 100 \times (\text{Observed} - \text{Expected})/\text{Observed}.$$

Because the models selected showed a good fit to the data, the observed number of low-birthweight infants in the population was very close to the one predicted by the binomial regression model.

Results

According to our study, the average infant mortality rate in Puerto Rico from 1986 through 1989 was 13.1 infant deaths per 1000 live births (76% died in the neonatal period), and the average low-birthweight rate was 8.9 per 100 live births (90% of low-birthweight infants weighed between 1500 and 2499 g at birth). During this period, approximately 1 in 6 mothers were under 20 years of age, 1 in 3 were unmarried, 1 in 3 had less than 12 years of formal education, 2 in 3 gave birth in public hospitals, and 1 in 50 were unable to obtain any prenatal care (Table 1). Of all deliveries in the public sector, 99% occurred in hospitals owned by the Puerto Rico Department of Health. Public sector hospitals were more likely than private sector hospitals to receive mothers under 20 years of age (25% vs 4%), unmarried mothers (45% vs 12%), and mothers with less than 12 years of formal education (50% vs 9%).

TABLE 1—Low Birthweight (< 2500 g) and Infant Mortality Rates, by Selected Maternal Characteristics: Puerto Rico Birth Cohorts, 1986/87 through 1989/90

Maternal Characteristics	No. (%[a])	Low Birthweight[b]	Infant Mortality[b]	Neonatal Mortality[b]
Age y				
< 20	45 010 (17.5)	11.0	16.3	12.6
≥ 20	212 527 (82.5)	8.5	12.4	9.4
Marital status				
Unmarried	84 722 (32.9)	11.1	17.4	12.9
Married	172 815 (67.1)	7.8	11.0	8.5
Level of education, y				
< 12	91 214 (35.4)	10.7	16.1	11.7
≥ 12	166 323 (64.6)	7.9	11.4	9.0
Type of hospital				
Public	165 073 (64.1)	10.5	16.5	12.5
Private	92 464 (35.9)	6.1	7.3	5.5
Prenatal care				
None	5 207 (2.0)	19.9	49.5	39.4
Some	252 330 (98.0)	8.7	12.3	9.4
Total	257 537 (100.0)	8.9	13.1	10.0

[a] Percentage of total.
[b] Rate per 1000 live births.

Low-birthweight rates differed markedly according to the maternal characteristics examined in this study (Table 2). Mothers with no prenatal care were 2.29 (95% confidence interval [CI] = 2.16, 2.42) times more likely to deliver a low-birthweight newborn than were mothers who had some prenatal care. Mothers in public hospitals were 1.73 (95% CI = 1.68, 1.78) times more likely to deliver a low-birthweight newborn than were mothers in private hospitals. Unmarried mothers were 1.42 (95% CI = 1.39, 1.46) times more likely to deliver a low-birthweight infant than were married mothers (infants of single mothers and of mothers living in consensual unions had similar low-birthweight risks). Less educated mothers were 1.35 (95% CI = 1.32, 1.38) times more likely to deliver a low-birthweight infant than were more educated mothers. Mothers 19 years of age or younger were 1.29 (95% CI = 1.25, 1.33) times more likely to deliver a low-birthweight infant than were older mothers.

After adjusting for all other variables included in the model, we found that (1) the low-birthweight risk among mothers with no prenatal care was still 1.99 (95% CI = 1.88, 2.10) times higher than among women who received some prenatal care, (2) the risk among mothers delivering in public hospitals was still 1.55 (95% CI = 1.50, 1.60) times higher than the risk among mothers delivering in private hospitals, (3) the risk among unmarried mothers decreased and was 1.18 (95% CI = 1.15, 1.21) times higher than the risk among married mothers, (4) the risk among mothers 19 years old or younger decreased and was 1.07 (95% CI = 1.04, 1.11) times higher than the risk among older mothers, and (5) the risk among less educated mothers decreased and was 1.05 (95% CI = 1.02, 1.08) times higher than the risk among more educated mothers.

Infant mortality rates also differed markedly according to the maternal and infant characteristics examined (Table 3). Low-birthweight infants were 19.60 (95% CI = 18.28, 21.02) times more likely to die within their first year of life than were normal-birthweight infants. Infants of mothers who did not have prenatal care were 4.03 (95% CI = 3.57, 4.54) times more likely to die within their first year of life than were infants of mothers who did have some prenatal care. Infants delivered in public hospitals were 2.35 (95% CI = 2.16, 2.55) times more likely to die within their first year of life than were infants delivered in private hospitals. Infants of unmarried mothers were 1.58 (95% CI = 1.48, 1.69)

TABLE 2—Relative Risks and Population Attributable Risks of Low Birthweight, by Selected Maternal Characteristics: Puerto Rico Birth Cohorts, 1986/87 through 1989/90

		Adjusted Risk		
Maternal Characteristics	Crude Relative Risk	Model 1a Relative Risk[a]	Model 1b Relative Risk[b]	Population Attributable Risk
Age < 20 y	1.3	1.1	. . .	1.6
Education < 12 y	. . .	. . .	1.1	. . .
Education ≥ 12 y	. . .	. . .	1.0	. . .
Unmarried	1.4	1.2	. . .	6.6
Education < 12 y	. . .	. . .	1.2	. . .
Education ≥ 12 y	. . .	. . .	1.1	. . .
Education < 12 y	1.3	1.0	. . .	3.0
Age < 20 y, unmarried	. . .	. . .	1.2	. . .
Age < 20 y, married	. . .	. . .	1.1	. . .
Age ≥ 20 y, unmarried	. . .	. . .	1.1	. . .
Age ≥ 20 y, married	. . .	. . .	1.0	. . .
Public hospital	1.7	1.5	. . .	27.6
No prenatal care	. . .	. . .	2.0	. . .
Some prenatal care	. . .	. . .	1.6	. . .
No prenatal care	2.3	2.0	. . .	2.2
Public hospital	. . .	. . .	2.0	. . .
Private hospital	. . .	. . .	1.6	. . .

Note. The reference group in the relative risk estimates is the group with opposite attributes (i.e., the reference group for unmarried mothers is the group of all married mothers). The population attributable risk is the proportion of low-birthweight newborns potentially prevented if the risk associated with a given factor is eradicated from the population after adjustment is made for all other risk factors.

[a] Adjusted estimates with all main effects in the binomial multiple regression model but with no interactions included.

[b] Stratum-specific estimates with all main effects and statistically significant ($P < .05$) interactions included (hierarchical modeling).

times more likely to die within their first year of life than were infants of married mothers (infants of single mothers and of mothers living in consensual unions had similar risks of death). Infants of mothers with less than 12 years of schooling were 1.41 (95% CI = 1.32, 1.51) times more likely to die within their first year of life than were infants of more educated mothers. Infants of mothers 19 years old or younger were 1.31 (95% CI = 1.21, 1.42) times more likely to die within their first year of life than were infants of older mothers.

After adjusting for all other variables included in the model, we found that (1) the risk of death among low-birthweight infants was still 17.95 (95% CI = 16.72, 19.26) times higher than among normal-birthweight infants, (2) the risk among infants of mothers with no prenatal care was 2.04 (95% CI = 1.82, 2.30) times higher than among infants of mothers with some prenatal care, (3) the risk among infants delivered in public hospitals decreased and was 1.65 (95% CI = 1.50, 1.81) times higher than among infants delivered in private hospitals, (4) the risk among infants of unmarried mothers decreased and was 1.09 (95% CI = 1.01, 1.16) times higher than among infants of married mothers, (5) the risk among infants of less educated mothers decreased and was 0.94 (95% CI = 0.88, 1.02) times that among infants of more educated mothers, and (6) the risk among infants of mothers 19 years old or younger decreased and was 0.99 (95% CI = 0.91, 1.07) times that among infants of older mothers.

The risk of death among low-birthweight infants who had more educated mothers and were born in public hospitals was 1.9 times higher than the risk among low-birthweight infants who also had more educated mothers but were born in private hospitals. On the other hand, we found no difference in the risk of death among normal-birthweight infants who had less educated mothers and were born in public hospitals compared with normal-birthweight infants who also had less educated mothers but were born in private hospitals.

Discussion

Our results confirm that low birthweight is the most important determinant of infant mortality in Puerto Rico. Approximately 6 of every 10 infant deaths on the island could be prevented if low birthweight were eradicated, regardless of other associated factors (Table 3). The eradication of risk associated with the sociodemographic and socioeconomic factors included in our study (including hospital of birth) would potentially decrease the incidence of low birthweight in Puerto Rico by one third (Table 2). The elimination of the risk associated with hospital of birth alone, as a proxy for socioeconomic risk factors, would potentially decrease the incidence of low birthweight in Puerto Rico by 28%, regardless of other factors considered in our study.

By considering the impact of sociodemographic and socioeconomic factors on the entire population, we have demonstrated that the independent contribution of most of these factors was generally small after accounting for hospital of birth. Specifically, the independent contributions of age and marital status to the incidence of low birthweight were substantially lessened after accounting for hospital of birth. Therefore, health planners should reconsider the widely held expectation that infant mortality in Puerto Rico will significantly improve if interventions focus on younger pregnant mothers.

Although we could postulate an etiologic role for hospital of birth in contributing to the incidence of infant mortality,[1,5] it is not plausible to consider hospital of birth as a causal factor in the incidence of low birthweight. More likely, hospital of birth is another marker for socioeconomic disadvantage unaccounted for by variables such as maternal education and marital status. It is reasonable to assume that most patients served by the public sector in Puerto Rico lack private health insurance.

Hospital of birth may reflect nutritional practices, personal habits (such as illicit drug use, alcohol use, and smoking practices[6]), access to prenatal care,[7] psychological and social stresses,[11] and parenting skills, among other behavioral, social, environmental, and economic disadvantages that have been traditionally associated with the public health concept of race.[12]

The usefulness of the concept of race in medical and public health research has been reviewed recently.[12–17] Although the Puerto Rico Department of Health collects data on race in its vital statistics system, race has never been used in the analyses and reports of these data because it is believed to contain unavoidable and significant misclassification. In Puerto Rico, there is as yet no risk marker equivalent to the public health concept of race to help identify populations at high risk of low birthweight and infant mortality and thus rally support and target intervention strategies to prevent these outcomes. We propose that hospital of birth, instead of the public health concept of race, be used in Puerto Rico to define health care and pregnancy outcome gaps between the public and private sectors.

Our study also demonstrates, however, that hospital of birth is a significant independent contributor to infant mortality after controlling for birthweight, regardless of other sociodemographic factors. This finding suggests that the survival of infants delivered in public hospitals could be improved regardless of the sociodemographic profile of the mother.[1,5]

We found a complex but interesting relationship between maternal education and hospital of birth. The association between hospital of birth and infant mortality was substantially reduced among infants of less educated mothers. The relative risk of death associated with public hospitals was 60% to 90% higher among infants of more educated mothers but only 0% to 20% higher among infants of less educated mothers. This interaction is also reflected in the complex relationship between birthweight, hospital of birth, and maternal education (Table 3). The association between maternal education and infant mortality seems more pronounced among infants delivered in private hospitals. Conversely, it could be argued that the association between hospital of birth and infant mortality is more distinct among the more educated mothers. In fact, the (absolute) risk of death among low-birthweight infants who had less educated mothers was 86.5 per 1000 live births in public hospitals compared with 70.7 in private hospitals. Among low-birthweight infants who had more educated mothers, the risk of death was 111.3 per 1000 live births in public hospitals compared with 59.1 in private hospitals (data not shown). Therefore, maternal education may not fully reflect socioeconomic status among low-birthweight infants. On the other hand, the risk of death among normal-birthweight infants who had less educated mothers was 5.7 per 1000 live births in public hospitals compared with 5.6 in private hospitals. Among normal-birthweight infants who had more educated mothers, the risk of death was 5.1 per 1000 live births in public hospitals compared with 3.3 in private hospitals (data not shown). Therefore, normal-birthweight infants who had less educated mothers were at higher risk of death regardless of where they were born.

TABLE 3—Relative Risks and Population Attributable Risks of Infant Mortality, by Selected Maternal Characteristics: Puerto Rico Birth Cohorts, 1986/87 through 1989/90

		Adjusted Risk		
Maternal/Infant Characteristics	Crude Relative Risk	Model 2a Relative Risk[a]	Model 2b Relative Risk[b]	Population Attributable Risk
Low birthweight	19.6	17.9	...	62.0
Public hospital, education < 12 y	...	...	15.1	...
Public hospital, education ≥ 12 y	...	...	21.8	...
Private hospital, education < 12 y	...	...	12.6	...
Private hospital, education ≥ 12 y	...	...	18.1	...
Age < 20 y	1.3	1.0	...	0.2
Education < 12 y, no prenatal care	...	...	1.4	...
Education < 12 y, some prenatal care	...	...	1.0	...
Education ≥ 12 y, no prenatal care	...	...	1.1	...
Education ≥ 12 y, some prenatal care	...	...	0.8	...
Unmarried	1.6	1.1	1.1	3.6
Education < 12 y	1.4	0.9	...	−1.0
Low birthweight, public hospital, age < 20 y	...	...	1.0	...
Low birthweight, public hospital, age ≥ 20 y	...	...	0.8	...
Low birthweight, private hospital, age < 20 y	...	...	1.6	...
Low birthweight, private hospital, age ≥ 20 y	...	...	1.2	...
Normal birthweight, public hospital, age < 20 y	...	...	1.4	...
Normal birthweight, public hospital, age ≥ 20 y	...	...	1.1	...
Normal birthweight, private hospital, age < 20 y	...	...	2.2	...
Normal birthweight, private hospital, age ≥ 20 y	...	...	1.7	...
Public hospital	2.3	1.6	...	22.6
Low birthweight, education < 12 y	...	...	1.2	...
Low birthweight, education ≥ 12 y	...	...	1.9	...
Normal birthweight, education < 12 y	...	...	1.0	...
Normal birthweight, education ≥ 12 y	...	...	1.6	...
No prenatal care	4.0	2.0	...	3.9
Age < 20 y	...	...	2.5	...
Age ≥ 20 y	...	...	1.9	...

Note. The reference group in the relative risk estimates is the group with opposite attributes (i.e., the reference group for low-birthweight infants is the group of all normal-birthweight infants). The population attributable risk is the proportion of infant deaths potentially prevented if the risk associated with a given factor is eradicated from the population after adjustment is made for all other risk factors.

[a] Adjusted estimates with all main effects in the binomial multiple regression model but with no interactions included.

[b] Stratum-specific estimates with all main effects and statistically significant ($P < .05$) interactions included (hierarchical modeling).

We did not attempt to assess the full effect of prenatal care on low birthweight and infant mortality. In fact, our classification of prenatal care as "none" or "some" reflects how crudely we were able to approach this matter. Using vital records in Puerto Rico, other researchers have found no appreciable differences in pregnancy outcomes examined according to the trimester in which prenatal care began.[7] Therefore, the low population attributable risks associated with prenatal care should not be viewed as evidence of ineffectiveness but as evidence of our inability to measure what really works and what does not work in prenatal care. Nevertheless, our analysis suggests that a lack of prenatal care either sorts out those at high risk of low birthweight and infant mortality or is associated with a twofold increase in both, regardless of other risk factors. The impact of this increased risk on the population as a whole is constrained by the low prevalence of women with no prenatal care on the island.

The results of this and previous studies[1,5] are being used to document the need to improve the perinatal health care provided in Puerto Rico's public hospitals, and a special tax has been enacted for making such improvements. Few neonatal intensive care beds are available in Puerto Rico's private sector, because most high risk neonates are usually transferred to tertiary, public health care facilities. Therefore, the special tax revenues will be used to reduce infant mortality by improving the survival of newborns in Puerto Rico.

The Puerto Rico Department of Health has also launched a major initiative to improve the access, quantity, and quality of prenatal care in the public sector. Health officials in Puerto Rico agree that the most cost-effective way to reduce infant mortality is to prevent low birthweight through universal access to timely and good prenatal care.[18] Of course, further studies are needed to sort out the risk factors associated with low birthweight due to preterm delivery and to intrauterine growth retardation because vital statistics data do not provide reliable information on gestational age.[19] Further studies are also needed to assess how life-styles and personal habits, such as illegal drug use, smoking, and alcohol use, relate to pregnancy outcomes in Puerto Rico.

The prevention of low birthweight and infant mortality, as with most health outcomes, is seldom related to specific technological interventions. Public health officials and clinical practitioners can significantly improve infant mortality in Puerto Rico, however, by lowering birthweight-specific infant mortality risks.[1] Long-term prevention strategies designed to improve infant mortality, on the other hand, more likely will be associated with reducing the gap in low birthweight between the private and public sectors. ☐

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Prescription and Nonprescription Drug Use among Black and White Community-Residing Elderly

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ABSTRACT

Objectives. To examine and compare concomitants of prescription and nonprescription drug use of Black and White community-dwelling elderly.

Methods. Information on prescription and nonprescription drug use, demographic and health characteristics, and use of health services was obtained from a probability-based sample of Black (n = 2152) and White (n = 1821) community-resident elderly in the Piedmont area of North Carolina. Descriptive statistics were calculated. Linear regression, in which sample weights and design effects were taken into account, was used for the final models.

Results. For prescription drug use, 37% and 32% of the variance was explained for Whites and Blacks, respectively (6% and 5% for nonprescription drugs). Health status and use of medical services were the strongest predictors of prescription drug use for both races (with Medigap insurance also important for Whites and Medicaid important for Blacks). Demographic characteristics and self-assessed health were significant factors in the use of nonprescription drugs. Race independently predicted use of both types of drugs but explained only a small proportion of the variance.

Conclusions. Health status and use of health services are importantly related to prescription drug use. Nonprescription drug use is difficult to explain. (*Am J Public Health.* 1993;83: 1577–1582)

Introduction

The elderly, who represent 12% of the population, have been reported to take 30% of all prescription medications.[1] Higher prescription drug use has been reported for persons who are older, female, and in poorer health; who have more impaired activities of daily living; and who have a secondary reimbursement source (e.g., health insurance or Medicaid). Those who have a higher income, who are employed, or who have had more years of education, and those who are Black have been found to be less likely to use prescribed medications.[1–11] The finding of lower medication drug use among Blacks[11] is particularly perplexing because, by most criteria, their health is poorer[12]; consequently, their use of medications would be expected to be greater than that of non-Blacks.

Although the elderly are also frequent users of nonprescription drugs,[5] information on the factors associated with the use of such drugs is scantier than that for prescription drugs. In general, reported findings indicate that women and those who are White are more likely to be taking nonprescription drugs, but the association of nonprescription drug use with age is unclear.[4,5,10,11] A number of reasons for nonprescription drug use have been proposed: these drugs may be used by persons who perceive medical care to be unavailable, by those who are more anxious, or as a substitute for or in conjunction with prescription drugs.[2,13–15] Factors consistently reported to be associated with prescription drug use (e.g., income, education, socioeconomic level, health status) are not consistently related to use of nonprescription drugs.[16]

Few studies have examined racial differences in drug use while taking into account interrelated predictors of such use.[13–15,17–22] The main purpose of the present study, then, was to examine determinants of the use of prescription and nonprescription drugs by elderly Black and White community residents using a multivariate approach. Second, we wished to determine whether the model that explains prescription drug use would also explain nonprescription drug use.

Methods

Sample

The data come from the in-home baseline survey (1986 to 1987) of the Duke Established Populations for Epidemiologic Studies of the Elderly.[23,24] In brief, the study sample consists of a stratified

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probability household sample of 4163 community residents aged 65 or older living in five adjacent urban and rural counties in the Piedmont area of North Carolina. To increase statistical precision, Blacks were oversampled, constituting 54% of those interviewed compared with 35% of the same age population. Analysis weights take initial nonresponse into account, correct for the oversampling of Blacks, and allow inference to the five-county area at the time of the survey. The Duke study was approved by the Duke University Medical Center Institutional Review Board, and informed consent was obtained from each participant before data were gathered.

The present analysis excluded 30 subjects who were neither Black nor White, and 160 subjects with only proxy data since information on their self-assessed health status was unavailable. Hence, the analysis data set included 2152 Black and 1821 White elderly, of whom 1727 (80.3%) and 1588 (87.2%), respectively, responded to each item analyzed.

Data Collection

Information was obtained by means of a 90-minute, in-person interview in the home. The interview schedule has been published.[23] Relevant available data include (1) demographic characteristics; (2) limited information on health conditions (i.e., the presence of a heart condition, stroke, cancer, diabetes, hypertension), self-assessed health (a single item), and physical health functioning; and (3) measures of use of selected health care services and professionals, income, and health insurance.

The name, strength, and dosage form of each medication taken in the prior 2 weeks or to be taken as needed were recorded.[11]

Drug Data Entry

Each drug was assigned a unique four-digit generic code from the DPICS and IN-DPICS coding system[5] using a locally developed interactive data entry program,[11] and each was further numerically coded to indicate whether it was a prescription or nonprescription product. Reliability of drug data entry, which was tested by re-entering a 5% sample, was found to be highly satisfactory, with the rate of coding errors estimated to be 1.63% (95% confidence interval = 0.71%, 2.55%).

Model Development

A health care services use model[25] was chosen to explore prescription and nonprescription drug use. Specifically, use of medications was expected to be influenced by demographic characteristics, health status, and factors that facilitate or hinder drug use.

The demographic characteristics included race (Black/White), sex, age and education (both in years), marital status (married/not currently married), and current residence in an urban or rural area.

Health status was assessed by three measures. The first, a medical status score, summarized the medical impact of five common chronic health conditions (heart condition, stroke, cancer, diabetes, and hypertension). These physical health conditions were the only ones present that had any medication-related relevance. The medical status score reflected the averaged evaluations (summed over all five conditions) made by 36 clinicians experienced in the care of the elderly; the evaluations were made regarding the extent to which each condition had an impact on health status. In making these evaluations, the clinicians considered all available information. For instance, in rating heart condition, they took into account any report of heart attack and, if there were any such reports, factored in how many, how recently, and whether there was a related hospitalization. The manner of development of the medical status scale ensured that it had content validity; it also had construct validity, summary scores being related to selected aspects of health services use, self-rated health, and activities of daily living in the expected manner. Thus, this measure is valid and maximizes the information available.

The two additional measures of health status included self-rated health (a 4-point scale in which 0 = poor and 3 = excellent) and a measure of functional physical health (three items of the Rosow and Breslau scale,[26] in which the score was the number of items the subject had difficulty performing, with missing values imputed where possible).

Items facilitating or hindering drug use included the number of outpatient visits in the past 12 months to a medical professional for a physical health problem, whether the same health care professional was usually seen on each visit, and hospitalization in the previous year. Additionally, they included not being on Medicaid (which in North Carolina pays for prescription medications); enrollment in Medicare (which financially facilitates access to medical care and hence to receipt of a prescription); supplementary health insurance (which may pay toward prescription medications); and adequacy of income.

Statistical Analysis

Descriptive statistics were calculated separately for Blacks and Whites. To examine the impact of missing data, use of prescription and nonprescription drugs by full and partial responders was compared using Student's t test. For all other variables (demographic, health status, facilitating/hindering characteristics), information on the individual comparisons was combined and an omnibus test was carried out (Fisher's Inverse Chi-Square Method based on P values derived from Wilcoxon's signed rank test or the Kruskal-Wallis statistic).[27]

For prescription and nonprescription drugs, the proportions of Black and White respondents using at least one drug were compared using chi-square tests. Comparison of mean drug use by race was made using Student's t test.

Multivariate models were constructed using forward linear regression, introducing blocks of demographic, health status, and facilitating/hindering variables successively as predictors of the number of drugs used. Separately for prescription and nonprescription drug use, models were run for Blacks, Whites, and both races combined; the latter model included an indicator variable for race. All models used analysis weights. Initial models were run in SAS, using procedure REG[28]; final models considered sample design effects and were implemented in SURREGR.[29,30]

To determine the impact of excluding partial responders from the models, all but the final stage of each series of models was run with partial responders included where they were not automatically deleted by the software.

Results

Sample Characteristics

Table 1 shows the characteristics of responders in the current sample. For both Blacks and Whites, those who responded to each item were less impaired than those who did not ($P < .0001$). On average, partial responders reported more prescription and fewer nonprescription drugs than full responders. They tended to be older, less educated, in poorer functional and self-assessed health, and more likely to have been hospitalized in the previous year. If Black, they were less likely to be married; if White, they were more likely to be female and less likely to have supplementary health insurance. The exclusion of partial responders from analysis appears to have had little impact on the findings.

Prevalence and Extent of Drug Use, Both Types

In the present study, 76% of White and 74% of elderly Black community residents took at least one prescription drug, a nonsignificant difference. However, Black users took significantly fewer prescription drugs (mean = 2.79, SD = 1.75) than did White users (mean = 3.19, SD = 2.20; t = 5.53, df = 2693; $P < .0001$). Only 67% of Blacks compared with 76% of Whites (χ^2 = 43.26, df = 1; $P < .0001$) reported taking nonprescription drugs. Of those reporting such use, Blacks again took significantly fewer nonprescription drugs (mean = 1.69, SD = 1.01) than did Whites (mean = 1.89, SD = 1.18; t = 4.86, df = 2804; $P < .0001$).

Although here the health status of Blacks appears to be similar to that of Whites, Blacks use fewer drugs of either type. They are also less likely than their White counterparts to be married and to have supplementary health insurance; they also have less education and are in more straitened economic circumstances.

TABLE 1—Characteristics of Black and White Responders to the Baseline Survey (Weighted Data with Unweighted n)

	Black Responders (n = 1727)		White Responders (n = 1588)	
Variables[a]	Mean[b]	SD	Mean[b]	SD
Demographic characteristics				
Female sex	0.63		0.61	
Not currently married (vs married)	0.53		0.44	
Urban residence (vs rural)	0.56		0.57	
Age, y	72.83	5.02	72.79	7.22
Education, y[c]	7.67	3.31	10.37	4.37
Health status characteristics				
Impaired functional status	0.84	0.88	0.75	1.26
Poor medical status	31.54	25.08	30.45	36.36
Better self-rated health	1.49	0.70	1.65	1.07
Facilitating/hindering characteristics				
Physical health visits in past year, n	4.64	4.58	4.60	7.73
Same physician seen on each visit	0.78		0.89	
Overnight hospitalization in past year	0.15		0.16	
Not on Medicaid	0.91		0.97	
On Medicare	0.93		0.97	
No other health insurance	0.63		0.22	
Adequacy of income	0.48		0.80	
Dependent variables				
Prescription drugs reported, n	1.93	1.50	2.30	2.69
Nonprescription drugs reported, n	1.15	0.94	1.42	1.54

[a] See the Methods section for descriptions of variables.
[b] Proportion for dichotomized variables.
[c] More than 17 years coded as 17.

Predictors of Prescription Drug Use

For elderly White community residents (Table 2), demographic characteristics explained a minimum amount of variance (0.8%), those with poor education being heavier consumers of prescription drugs. When health status was also considered, an additional 30% of variance in prescription drug use was explained. For each health measure, poorer standing indicated greater prescription drug use. A further 6.4% of variance was explained by facilitating/hindering characteristics, for a total of 37.2% of variance explained. Of the latter characteristics, the number of visits to a physician, the same physician seen on each occasion, overnight hospitalization in the previous year, and the presence of Medicaid and of supplementary health insurance were significant predictors of prescription drug use. With the inclusion of the facilitating characteristics, level of education lost its significance but area of residence became important: among White elderly, urban area residents were likely to be taking more prescription drugs than rural area residents.

For elderly Black community residents (Table 3), demographic characteristics explained 3.2% of the variance in pre-

TABLE 2—Concomitants of Use of Prescription Drugs among Elderly White Community Residents (n = 1588): β Coefficients and Standard Errors (SE) in a Forward Multiple Linear Regression Analysis

	Stage 1		Stage 2		Stage 3	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	1.43	.74	2.20	.62	1.76	.70
Demographic characteristics						
Female sex	.19	.13	.20	.11	.17	.11
Not currently married	.07	.13	−.08	.11	−.02	.11
Urban residence	.10	.12	.18	.10	.21	.10*
Age	.02	.01	−.01	.01	−.01	.01
More education	−.05	.02**	.04	.01**	.02	.01
Health status characteristics						
Impaired functional status			.54	.05***	.43	.05***
Poor medical status			.01	.00***	.02	.00***
Better self-rated health			−.61	.06***	−.51	.06***
Facilitating/hindering characteristics						
Number of physical health visits in past year					.56	.06***
Same physician seen on each visit					.61	.15***
Overnight hospitalization in past year					.40	.13**
Not on Medicaid					−.59	.29*
On Medicare					−.07	.26
No other health insurance					−.32	.12**
Adequacy of income					.13	.13
R^2 adjusted	.008		.308		.372	

$^*P < .05$; $^{**}P < .01$; $^{***}P < .001$.

TABLE 3—Concomitants of Use of Prescription Drugs among Elderly Black Community Residents (n = 1727): β Coefficients and Standard Errors (SE) in a Forward Multiple Linear Regression Analysis

	Stage 1		Stage 2		Stage 3	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	1.34	.55	1.30	.51	.80	.51
Demographic characteristics						
Female sex	.73	.10***	.56	.09***	.42	.09***
Not currently married	−.03	.10	−.05	.09	−.01	.08
Urban residence	−.02	.09	.08	.08	.12	.08
Age	.00	.01	.00	.01	.00	.01
More education	.00	.01	.03	.01**	.01	.01
Health status characteristics						
Impaired functional status			.28	.04***	.19	.01***
Poor medical status			.02	.00***	.01	.00***
Better self-rated health			−.44	.05***	−.37	.05***
Facilitating/hindering characteristics						
Number of physical health visits in past year					.54	.05***
Same physician seen on each visit					.55	.09***
Overnight hospitalization in past year					.19	.11
Not on Medicaid					−.49	.14***
On Medicare					.30	.15*
No other health insurance					−.08	.09
Adequacy of income					.06	.09
R^2 adjusted	.032		.229		0.315	

*$P < .05$; **$P < .01$; ***$P < .001$.

TABLE 4—Concomitants of Nonprescription Drug Use among Elderly White Community Residents (n = 1586): β Coefficients and Standard Errors (SE) in a Forward Multiple Linear Regression Analysis

	Stage 1		Stage 2		Stage 3	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	1.84	.42	1.98	.42	1.75	.49
Demographic characteristics						
Female sex	.33	.47***	.33	.07***	.30	.08***
Not currently married	.08	.08	.06	.07	.06	.08
Urban residence	.25	.07***	.26	.07***	.29	.07***
Age	−.01	.01*	−.01	.01*	−.02	.01**
More education	.00	.01	−.02	.01	.02	.01*
Health status characteristics						
Impaired functional status			.06	.04	.06	.04
Poor medical status			.00	.00*	.00	.00*
Better self-rated health			−.14	.04**	−.11	.04*
Facilitating/hindering characteristics						
Number of physical health visits in past year					.13	.04**
Same physician seen on each visit					.13	.10
Overnight hospitalization in past year					−.06	.09
Not on Medicaid					−.05	.20
On Medicare					.18	.18
No other health insurance					−.02	.09
Adequacy of income					−.13	.09
R^2 adjusted	.028		.054		.060	

*$P < .05$; **$P < .01$; ***$P < .001$.

scription drug use, with only sex being statistically significant: Black women were higher users of prescription drugs (or rather, Black men were particularly low users). When health status was also considered, 22.9% of the variance was explained. Poor health status as assessed by each of the three measures predicted increased prescription drug use. Addition of the facilitating/hindering variables increased the amount of variance explained to 31.5%, with making more frequent visits to a physician, consistently seeing the same physician, having Medicaid, and having Medicare being significant predictors of prescription drug use.

Finally, a model was run that included both Black and White elderly residents (tables available from the authors). This model explained 36.6% of the variance in prescription drug use. Race per se was statistically significant and contributed 1.3% to the overall variance. All characteristics found to be significant predictors of prescription drug use in the separate models for White elderly and Black elderly (with the exception of Medicare, significant for Black elderly, and Medigap insurance, significant for White elderly) were statistically significant. Race interaction effects showed that Black elderly with impairments on the Rosow-Breslau[26] and Black elderly women who had been hospitalized in the previous year were likely to use fewer drugs than their White counterparts, whereas White elderly women who reported their health to be poorer were particularly high prescription drug users.

Predictors of Nonprescription Drug Use

Among elderly White community residents (Table 4), all variables combined explained 6.0% of the variance (demographic characteristics explained 2.8%, and the addition of health status explained 5.4%). Female sex, urban residence, younger age, more education, poor self-rated health and medical status, and an increased number of physician visits were statistically significant predictors.

The explanatory power of the model was less for elderly Black community residents (Table 5). In all, 4.8% of the variance in nonprescription drug use was explained. The only important characteristics were being female, considering one's health to be poorer, having supplemental health insurance, and not being on Medicaid.

A model that included information from both Black and White elderly residents explained 6.4% of the variance in nonprescription drug use. Race per se was statistically significant, contributing 0.7%. All characteristics found to be statistically significant in either the nonprescription model for White elderly or that for Black elderly were also statistically significant in the combined race model, with the exception of Medicaid and supplemental health insurance.

TABLE 5—Concomitants of Nonprescription Drug Use among Elderly Black Community Residents (n = 1727): β Coefficients and Standard Errors (SE) in a Forward Multiple Linear Regression Analysis

	Stage 1		Stage 2		Stage 3	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Intercept	0.60	.35	0.73	.35	0.57	.38
Demographic characteristics						
Female sex	.33	.06***	.30	.00***	.29	.06***
Not currently married	−.04	.06	−.04	.06	−.02	.06
Urban residence	.10	.06	.13	.06	.12	.06
Age	.00	.00	.00	.00	.00	.00
More education	.00	.01	.01	.01	.00	.01
Health status characteristics						
Impaired functional status			.04	.03	.04	.03
Poor medical status			.00	.00	.00	.00
Better self-rated health			−.18	.03***	−.18	.04***
Facilitating/hindering characteristics						
Number of physical health visits in past year					.14	.04
Same physician seen on each visit					−.06	.07
Overnight hospitalization in past year					.04	.08
Not on Medicaid					.23	.10*
On Medicare					.14	.11
No other health insurance					−.14	.07*
Adequacy of income					−.10	.07
R^2 adjusted	.017		.044		.048	

*$P < .05$; **$P < .01$; ***$P < .001$.

Discussion

These data allow us to compare the characteristics of Black and White elderly who represent all socioeconomic levels and who live in both urban and rural settings in a defined geographic area. As such, our data are unique, permitting comparisons not hitherto feasible. While descriptive information on the prescription and nonprescription drug use of minority groups exists,[8,11] studies of drug use in the elderly based on multivariate techniques have been restricted by the relative youth of sample members (under age 65), small sample sizes, limited representativeness, and lack of information on race.[6,10,14]

We found that, with other factors controlled, race made a statistically significant, if substantively small, contribution to explaining prescription drug use. The multivariate health care services use model explained up to 37% of the variance in prescription drug use. Demographic characteristics had little explanatory power although, in the absence of other data, they seemed to act as proxies for health status and use of health care services. Similarly, the importance of other characteristics (e.g., living in an urban area where transportation may be easier and pharmacies more numerous) only became evident with concomitant consideration of additional information.

It has been suggested that access to prescription drugs is based on formal health system factors.[13,14] Certainly here, prescription drug use is predominantly explained by health status and use of the health care system, just those factors that can result in a prescription.[31] It is also important to note that having Medicaid (which pays for drugs for the medically indigent) was a significant predictor of prescription drug use.

Although the primary determinants of prescription drug use (i.e., poor health status, more frequent medical visits, and the same physician seen on those visits) are similar for elderly Black and White community residents, there are some unique differences. For example, living in an urban area and recent overnight hospitalization are important in explaining prescription drug use for elderly Whites but not for elderly Blacks.

In common with other investigators,[13–15] we also find that the health services use model explains nonprescription drug use poorly. Access to nonprescription drugs is not bound by medical or legislative constraints. Unlike the case for prescription drug use, demographic characteristics were particularly important: being White, female, younger, better educated, and an urban area resident were predictive of nonprescription use. Indeed, these are the people to whom nonprescription drug use is targeted. While poorer health might also be relevant, it is unclear from these data whether nonprescription drugs substituted for or supplemented the use of prescription drugs.

The nonprescription use models for Black elderly differ from those for White elderly in that they reflect concern about health, particularly by women, and about the availability of some money to spend on it.

In the present study, race per se is a significant predictor of both kinds of drug use. Black elderly, particularly Black men, are likely to take fewer prescription drugs. However, the reasons for this are unclear. Possibly physicians prescribe differently for Black elderly as compared with White elderly.[10] Another possibility is that Black elderly may face restrictions in economic access to drugs. A larger proportion of White elderly than of Black elderly have supplementary health insurance, which may pay for prescription drugs. Conversely, a higher proportion of Black elderly are on Medicaid, and while Medicaid facilitates the use of prescription drugs, not all physicians will accept Medicaid patients and the program places restrictions on the number of reimbursable drugs that can be received in a given time interval. Other financial restrictions may also be present. Thus, the presence of Medicaid modifies but does not close the racial gap in prescription drug use. With respect to nonprescription drug use, Black elderly, in particular Black men, are again low users, but elderly Black users of nonprescription drugs appear to have a financial background comparable to that of White elderly.

The present study has some limitations. For one thing, current analysis is based on cross-sectional data. We are assuming that poor health leads to the use of medical care services, which results in prescriptions and the use of prescription drugs. The reverse is possible but is distinctly less likely. For another thing, information from some sample members is incomplete; however, this appears to have had little effect on the findings, except perhaps to make them slightly more conservative. More important, the lack of information on psychiatric conditions and on other physical conditions such as arthritis may have decreased the explanatory power of the models, particularly regarding nonprescription drugs. Lastly, current analyses also do not address the issue of appropriateness of drug use. That will be the focus of a future study.

Despite these limitations, the current study provides population-based information for both Black and White elderly residents, showing that the use of prescription drugs is largely governed by the same characteristics for each group (although unique race characteristics still exist). In addition, the study points to the importance of the Medicaid program in equalizing access to prescription drugs, and it shows that an alternative model is needed to explain the use of nonprescription drugs. ☐

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Insurance, Income, and Access to Ambulatory Care in King County, Washington

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ABSTRACT

Objectives. We studied simultaneous effects of income and insurance on access measures in an indigent population, focusing on Medicaid and the marginal effects of increasing income.

Methods. Surveys were distributed in waiting rooms of county clinics and welfare offices. Models examined insurance (private, Medicaid, or none), income (to twice the poverty level), single-parent status, age, gender, and presence of a regular source of care; first-order interactions were evaluated.

Results. In terms of ease of access, postponing care, and having a regular source of care, uninsured respondents fared worst and Medicaid recipients were at an intermediate level. However, relative to those with private insurance, Medicaid recipients had four times the odds, and uninsured respondents twice the odds of being denied care. Income had no consistent effect; however, older, poorer people may have greater problems. For preventive services, income was significant, while differences between Medicaid and private insurance were generally not significant.

Conclusions. Except for denial of care, access for indigent people is improved by Medicaid but remains worse than the access of those with private insurance. Income had variable effects, but support for income criteria used for public insurance eligibility was not found. (*Am J Public Health.* 1993;83:1583–1588)

Introduction

Access to medical care for indigent populations remains a problem in the United States. Income and insurance are two factors widely regarded as being important for access. However, little evidence exists indicating whether income in the range used in determining Medicaid eligibility has a meaningful impact on access. Enacted to provide health insurance coverage to the indigent, Medicaid currently covers less than 50% of those below the federal poverty level, a proportion that has been declining since 1975.[1] Furthermore, states set benefits and eligibility levels; thus, in 1988, the maximum family income for Medicaid eligibility through Aid to Families with Dependent Children ranged from 14.6% of the federal poverty level in Alabama to 85.8% in Utah.[2]

Medical insurance, especially Medicaid, does not guarantee adequate access. Medicaid has been reported to eliminate the lower rate of physician visits experienced by indigent populations; however, there is debate as to whether this holds after adjustment for health status.[2–10] A study of Medicaid expansion for obstetrical care in Tennessee did not indicate improvements in obtaining timely prenatal care or in birth outcome,[11] although termination of Medicaid benefits has been shown to result in worse access and outcomes.[12] Medicaid recipients and uninsured persons have been found to have increased rates of avoidable hospitalization.[13,14]

Income has been reported to be an important determinant of access,[4,5,14–21] but many studies have not controlled for its association with insurance status. People at upper income levels, whether insured or not, probably experience fewer barriers to care than do people at lower levels, and their inclusion in comparisons may produce effects not present in lower income groups. One study of insured adults found that income was correlated with access, but the study included too few poor persons to analyze whether this effect was attributable to income or Medicaid.[16] In women 45 to 64 years of age, lack of insurance coverage was the strongest predictor of receiving preventive services, while income was generally not a significant predictor.[22] In a clinic population, a study limited to persons with incomes up to twice the federal poverty level found insurance to be highly significant and income not significant for having a regular source of care and having at least one physician visit in the previous year.[23] In a national survey, Medicaid was a fairly important factor for predicting better access for children under 5 years of age, while income had a modest and not always significant effect.[24]

Having a regular source of care can be considered both a predictor and a measure of access.[5,8,16,18,25] Being able to identify a specific care provider has been reported to be a crucial factor in improved access.[6,14,15] In a recent study, income was not significant in predicting having a regular source of care; however, poor individuals were much more likely to lack a regular source of care for financial reasons. Those who were insured were twice as likely as those who were uninsured to have a regular source of care.[26]

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Inadequate access may also result in deferral and denial of care. Six percent of the US population has been estimated to have needed but not received care[18,19]; estimates vary (e.g., 0.4%,[27] 1.5% [3.2% for low-income persons],[28] and 2%[15]) as to the percentage of people who have been denied care as a result of lacking money or insurance. Those with public insurance have reported the same[19] or a higher[15] frequency of being denied care as have those who are uninsured.

Between 1980 and 1990, the population of King County, Washington, increased approximately 25%, with greater growth occurring outside of Seattle and in the low income population. According to the 1990 census, the incomes of 15.6% of the county population are below 200% of the federal poverty level, and the incomes of 4.2% are below the federal poverty level. These are probably conservative estimates given the groups that tend to be underrepresented in the census. Approximately 3.4% of county residents and 2.2% of those residing outside of Seattle are Medicaid recipients. Approximately two thirds of the county's population lives outside of Seattle.

As the population increased, concern developed that access problems were increasing among poor residents, especially in areas outside of Seattle, and that county facilities were becoming overburdened. As part of a process for creating a master plan for county health services, the Seattle–King County Department of Public Health decided to survey access problems of current and potential users of its health care services.

We hypothesized that, in this relatively indigent population, insurance status would strongly predict access and income would not predict access; also, we hypothesized that Medicaid recipients would be at a level of access intermediate between privately insured and uninsured persons. Furthermore, we believed that single parenthood, in addition to its association with Medicaid eligibility, might serve as an indicator of greater socioeconomic difficulties.

Methods

Data Source

The survey instrument was developed by the health department and pilot tested with a focus group of 15 people chosen to be similar to the population expected to be present in the survey locations. Surveys were available in English, Spanish, Vietnamese, and Cambodian. They were collected anonymously in the waiting rooms of county clinics and welfare offices during spring through fall 1989 (south and east King County) and in fall 1990 (southwest King County). All persons present were asked to participate, and the surveyor was available to provide any needed assistance. Refusal rates were 5% to 10% on any given day.

Respondents were asked to estimate their monthly household income. Insurance status was ascertained by asking for all methods of paying medical bills; possible responses were self-pay, medical coupons (Medicaid), private insurance, unable to pay, and other.

Respondents were asked to rate, on a five-point Likert scale (ranging from "very easy" to "very hard"), how difficult it was for them to obtain checkups, illness care, mental health counseling, dental care, and affordable prescription drugs. Also, they were asked where they usually sought health care; choices included no regular source of care, health department clinics, community clinics, private doctors or clinics, emergency rooms, and other. Finally, they were asked whether, in the last 2 years, they (1) had put off seeking care because of lack of money or insurance, (2) had been denied care, and (3) had received the following preventive services: checkups, blood pressure checks, breast exams, and pelvic exams or Papanicolaou smears.

Analysis

Insurance status was classified as uninsured, Medicaid, privately insured, and both Medicaid and private insurance. The number of persons in the last category was too small to produce reliable estimates; thus, results for this group are not presented. Persons with only "other" coverage (e.g., Veterans Administration care) were also excluded.

Income was converted to a percentage of the federal poverty level for the year of the survey; categories were poor (<100% of the federal poverty level), near poor (100% through 149% of the federal poverty level), and other low income (150% to 200% of the federal poverty level). Expression of income as a continuous fraction of the federal poverty level did not significantly alter results of any of the analyses.

Respondents who reported not having a place they usually went to receive care or using a hospital emergency room were considered not to have a regular source of ambulatory care.

The Likert-scaled items were used as dependent variables in linear regressions performed with SPSS 4.0 (SPSS Inc., Chicago, Ill). In univariate analyses of these variables, linearity tests were used for income and age and F tests were used for differences of means for the other variables. Logistic regressions for categorical variables were performed with EGRET (Statistics and Epidemiology Research Corp., Seattle, Wash). Univariate significance for categorical outcomes was assessed with chi-square tests, and trend tests were used for income and age. All first-order interaction terms were evaluated; interactions are reported if they were either significant at $P < .01$ or significant for more than one of the measures at $P < .05$.

Results

Respondent Characteristics

A total of 2508 surveys were available for analysis. To remove Medicare as a possible confounder, persons 65 years of age or older (11) were excluded. Respondents who did not report income (152) or family size (546), did not report insurance status or reported only "other" (28), or indicated a family income greater than 200% of the federal poverty level (147) were not included in subsequent analyses. Respondents who reported incomes greater than 200% of the federal poverty level were excluded because some respondents clearly reported annual instead of monthly income. After these exclusions, 1624 surveys (64.8%) remained for analysis.

Respondents were predominantly female, poor, and Medicaid recipients (see Table 1). The mean age was 30 for women and 34 for men. The mean income was 84% of the federal poverty level for women and 81% for men; the median income was 76% of the federal poverty level. Half had Medicaid and 28% were uninsured. Only 0.5% of respondents lived alone, and children were present in 97.5% of all households. Those excluded by the above criteria were more likely to be male (25%), not to be single parents (71%), and to have either private insurance (35%) or no insurance (38%).

Analysis

The relative contributions of the different predictors were examined with linear regression models for the measures of perceived ease of access (Table 2), and with logistic regression models for the other, dichotomous outcome measures (Tables 3 and 4). Unadjusted data are discussed only when results of the regression

TABLE 1—Demographic Characteristics of Respondents

	No.	%
Insurance		
Private insurance	313	19
Medicaid	809	50
Medicaid and private insurance	47	3
Uninsured	455	28
Income		
Other low income (150%–200% of federal poverty level)	144	9
Near poor (100%–149% of federal poverty level)	323	20
Poor (<100% of federal poverty level)	1157	71
Single parent		
No	802	50
Yes	802	50
Sex		
Female	1472	91
Male	151	9
Age, y		
12–20	125	8
21–30	672	41
31–40	672	41
41–50	136	8
51–65	19	1

TABLE 2—Linear Regression Coefficients for Perceived Ease of Access after Other Factors are Controlled for

	Check-ups	Illness Care	Mental Health Care	Dental Care	Affordable Prescription Drugs
Constant	0.95*	0.98*	1.98	1.88	2.60*
Insurance					
Medicaid	.37**	0.23***	0.53†	0.46†	0.25
None	.77*	0.84*	0.82*	1.16*	0.99*
Income					
Near poor	0.17	0.15	−0.16	0.25	0.14
Poor	0.05	0.26	−0.18	0.29	−0.89
No regular source of care	0.74*	0.79*	0.65*	0.55*	0.55*
Single parent	−0.25***	0.82***	−0.14	−0.10	−0.11
Male	0.08	−0.06	−0.06	−0.12	−0.20
Age (y/10)	0.23*	0.21*	0.20**	0.15**	−0.12
Single parent × no reguler source of care	0.39†	...	...	...	...
Single parent × income interaction††					
Single parent × near-poor	...	−0.33	...	...	...
Single parent × poor	...	−0.79***	...	...	...
Age × income interaction†††					
Age × near-poor	...	...	...	...	0.09
Age × poor	...	...	...	...	0.40***
R^2	0.19	0.20	0.10	0.12	0.13

Note. Omitted (reference) category is private insurance for insurance and other low income for income. *$P < .0001$; **$P < .01$; ***$P < .05$; †$P < .001$ (t test for hypothesis $\beta = 0$); ††$P = .005$ by F test with 2 degrees of freedom for single parent × income category; †††$P = .01$ by F test with 2 degrees of freedom for age × income catetory.

TABLE 3—Odds Ratios for Access Barriers after Other Factors are Controlled for: Logistic Regression Models

	Odds Ratio (95% Confidence Interval)		
	No Regular Source of Care	Deferred Care (No $ or Insurance) Last 2 y	Denied Care, Last 2 y
Insurance			
Medicaid	1.9 (1.2, 2.8)	1.2 (0.8, 1.6)	3.9 (2.4, 6.3)
Uninsured	4.1 (2.8, 6.1)	2.7 (1.9, 3.8)	2.2 (1.3, 3.5)
Income			
Near poor	1.0 (.06, 1.8)	0.2 (0.03, 1.6)	0.03 (0.002, 0.4)
Poor	1.4 (.09, 2.2)	0.1 (0.01, 0.5)	0.08 (0.007, 0.8)
No regular source of care	...	1.9 (1.5, 2.5)	1.5 (1.2, 2.0)
Single parent	1.0 (0.8, 1.4)	0.9 (0.7, 1.1)	1.0 (0.8, 1.4)
Male	2.2 (1.5, 3.3)	0.6 (0.4, 0.9)	0.6 (0.4, 0.9)
Age (y/10)	...	0.7 (0.5, 1.2)	0.5 (0.2, 1.0)
Age > 40	0.5 (0.3, 0.9)	...	...
Age > 40 × single parent	4.3 (1.9, 9.6)	...	...
Age × income interaction			
Age × near-poor	...	1.5 (0.8, 2.7)*	3.1 (1.3, 7.3)**
Age × poor	...	2.1 (1.2, 3.5)	2.6 (1.2, 5.7)

Note. Omitted (reference) category is private insurance for insurance and other low income for income. *$P = .01$ and **$P = .02$ by likelihood ratio statistic with 2 degrees of freedom for age × income category interaction.

analyses differ notably from unadjusted results or when they convey significant additional information.

For perceived ease of access, average scores indicated check-ups (2.39) and illness care (2.35) were easiest to obtain, prescription drugs (2.84) were somewhat harder to obtain, and mental helath (2.97) and dental care (3.14) were the hardest to obtain, reaching averages of neutral to slightly difficult. Lacking a regular source of care was reported by 16% of those with private insurance, compared with 31% of Medicaid recipients and 48% of the uninsured. Putting off care was common for all respondents, but more common for the uninsured (81%) than others (58%). Receipt of the different preventive services ranged from 60 to 75% of respondents overall.

For all of the perceived ease of access measures and the access barriers (deferring care, being denied care, and having no regular source of care), insurance status was the strongest predictor; for receipt of preventive services, insurance status was significant but was not the most important factor. In general, uninsured respondents had the worst access, and Medicaid recipients were at an intermediate level of access and often significantly different from both of the other groups. For example, being uninsured shifted responses for perceived difficulty approximately one point on the five-point scale; Medicaid status shifted responses one-fourth to one-half point.

A striking exception to this trend is

TABLE 4—Odds Ratios for Receipt of Preventive Services in the Previous 2 Years after Other Factors are Controlled for: Logistic Regression Models

	Odds Ratio (95% Confidence Interval)			
	Checkup	Blood Pressure Check	Breast Exam	Pelvic Exam or Papanicolau Smear
Insurance				
Medicaid	0.6 (0.4, 0.9)	0.8 (0.6, 1.2)	0.8 (0.6, 1.2)	0.8 (0.5, 1.3)
Uninsured	0.6 (0.4, 0.8)	0.6 (0.4, 0.9)	0.6 (0.4, 0.9)	0.6 (0.4, 0.9)
Income				
Near poor	4.1 (0.4, 38)	0.5 (0.3, 0.8)	0.5 (0.3, 0.8)	0.4 (0.2, 0.8)
Poor	7.7 (1.0, 61)	0.5 (0.3, 0.8)	0.5 (0.3, 0.7)	0.4 (0.2, 0.7)
No regular source of care	0.5 (0.4, 0.6)	0.6 (0.4, 0.7)	0.6 (0.5, 0.8)	0.7 (0.5, 0.9)
Single parent	1.2 (0.9, 1.6)	1.0 (0.8, 1.3)	1.1 (0.9, 1.4)	1.0 (0.7, 1.3)
Male	0.6 (0.4, 0.9)	0.8 (0.5, 1.1)	...	...
Age (y/10)	2.0 (1.0, 3.8)	0.8 (0.7, 0.9)	0.8 (0.7, 0.9)	0.8 (0.6, 0.9)
Age × income interaction*				
Age × near poor	0.5 (0.2, 1.0)	...	...	...
Age × poor	0.4 (0.2, 0.8)	...	...	...

Note. Omitted (reference) category is private insurance for insurance and other low income for income.
*$P = .02$ by likelihood ratio (2 *df*).

that Medicaid recipients were most likely to report denial of care (OR = 3.9) while uninsured respondents were at an intermediate level (OR = 2.2) (Table 3). These odds ratios were only slightly decreased by adjustment, and it should be noted that even 10% of privately insured respondents reported denial of care.

Even before adjustment, income was significant only for some of the measures of perceived ease of access and barriers to access. In instances in which it was significant, lower income persons fared worse. After adjustment, some of these trends disappeared, and in the other cases significant interactions were found (Tables 2 and 3). In contrast, income remained strongly associated with receipt of preventive services after adjustment, with the poor and near poor having only about half the odds of the highest income group of receiving these services (Table 4).

Five significant income interactions were found, four of which were age–income interactions Tables 2–4). Their interpretation was not completely consistent but suggests, overall, that older, poorer respondents had poorer access. The fifth interaction, between income and single-parent status, involved receipt of illness care. Single parents had a trend for decreasing perceived difficulty with decreasing income, an effect opposite that observed before adjustment, while others had a smaller trend for increasing difficulty with decreasing income (Table 2).

After adjustment, having a regular source of care remained a strong predictor of improved access on all of the measures. For ease of obtaining checkups, there was a significant interaction between having a regular source of care and single-parent status. Not having a regular source of care increased the difficulty by more than a full category for single parents and by about two thirds of a category for those who were not single parents (Table 2).

Single-parent status was significant only in interactions. In addition to the two interactions discussed above, single-parent status interacted with age for having a regular source of care. Single-parent status had no discernible effect for respondents up to age 40; however, for respondents more than 40 years of age, single parents had four times the odds of those who were not single parents of lacking a regular source of care (Table 3).

Gender had no discernible effect on perceived ease of access after adjustment (Table 2); before adjustment, men reported significantly increased difficulty in obtaining checkups and illness care. Men were twice as likely as women to lack a regular source of care but half as likely to report deferral or denial of care (Table 3). Men were also less likely to have had a checkup, and they showed a trend in this direction for blood pressure checks (Table 4) that had been significant before adjustment.

Increasing age generally correlated with greater perceived difficulty (Table 2) and decreased odds of having received preventive services (Table 4).

Respondents from county clinics and welfare offices reported similar access problems. In instances in which they differed, those from welfare offices were more likely to report denial of care (OR = 1.5) and less likely to have received a breast examination (OR = 0.8). Respondents from welfare offices who had the lowest incomes were more likely than others to report putting off care; those with the highest incomes were less likely to defer care. Respondents from welfare offices who did not have a regular source of care reported slightly more difficult access to checkups and illness care than did those from county clinics (data not shown).

Discussion

In our population, insurance status predicted the greatest differences for perceived ease of access and barriers to access, and even many privately insured respondents reported access difficulties. For receipt of preventive services, insurance was one of several important predictors. Generally, Medicaid was associated with access measures that were at an intermediate level between private insurance and lack of insurance coverage. The finding that Medicaid recipients were even more likely to experience denial of care than were uninsured respondents was unanticipated and troubling. The reasons for this finding are unclear but may be related to recipients being unaware of which providers accept Medicaid and, perhaps, the greater likelihood of uninsured persons to defer care. Given such findings, the suggestion that access problems of poor uninsured persons can or should be addressed by Medicaid expansion appears unrealistic.

Associations involving income were less clear cut than those involving insurance. In general, adjustment for other factors eliminated the effects of income on perceived ease of access and barriers to care, but an income–age interaction was significant for three of the measures. These interactions suggest that older (over 30), poorer people in our population have more difficulty obtaining access to care, consistent with results from a study of preventive services in women that did not control for insurance.[29] Increasing income increased the odds of receiving blood pressure checks, breast exams, and pelvic exams or Papanicolaou smears. It is not clear why, contrary to the results of Woolhandler and Himmelstein,[22] income had little predictive value for ease of access and access barriers but was a strong and fairly consistent predictor for receipt of preventive services. Conceivably, our findings could have resulted from the frequent exclusion of preventive services from insurance coverage and their perception as "optional" services. These observations need to be clarified in future investigations, but their equivocal nature does not provide support for arbitrary income cutoffs less than twice the poverty level for Medicaid or other publicly supported health insurance.

Reporting a regular source of care was strongly associated with improved access on all measures. Consistent with previous findings, income was not an important predictor, and insurance was the most important predictor, of having a regular source of care.[26] Causality should not be inferred from such associations since, for example, those having a regular source of care may be persons who are more likely to seek care. This could explain why men were less likely to report a regular source of care but also less likely to report postponing and being denied care. Assigning persons without a regular source to providers may or may not improve access for those who have not found a source on their own.

Single-parent status showed no consistent effect. For many people, Medicaid eligibility is dependent on eligibility for Aid to Families with Dependent Children and, hence, single-parent status; however, such a criterion does not appear to be sensible from the perspective of access.

A number of weaknesses of the study should be considered. First, the respondents represent a use cohort, and responses are subject to a volunteer bias. However, representative samples of indigent people are difficult to obtain. Telephone samples underrepresent indigent persons,[18,30] which, although having little effect on population estimates, may seriously bias studies of the poor. Second, the number of persons in the highest income group in this study was relatively small, decreasing the power to detect effects of income. Third, more than 20% of the responses were excluded as a result of missing information concerning family size, and those respondents who were excluded may have been different from other respondents (e.g., mostly persons living alone). Fourth, because of the sampling strategy, men were underrepresented in the sample. Fifth, the questions used to elicit information about receipt of preventive services may have resulted in significant overestimates, since some respondents may have considered an illness-related visit to be a checkup and women receiving a pelvic exam may have mistakenly assumed that a Papanicolaou smear was performed or may have been unaware of the distinction between the two procedures. Finally, a number of the measures depend on actual or perceived need for services, but the survey instrument contained no information to assess health status and perceptions.

However, given that surveys were distributed in county clinics and welfare offices, there are probably needier and more disenfranchised populations not represented by this survey. Also, given the fluctuations in insurance status that occur with time,[31] the associations with insurance status we found are probably subject to a conservative bias.

It should be noted that the proportion of variance explained by the models for perceived ease of access was modest (in the range of 10% to 20%) (Table 2) and consistent with previous results.[15] There was also a large amount of unexplained variation for the categorical access measures. Clearly, many other factors are important in gaining access to health care. Insurance is, however, probably the most easily altered factor, and the results of this study suggest that public insurance by no means solves the access problems it was meant to address.

In summary, in this relatively indigent population, we found uninsured persons to have the worst access, Medicaid recipients to be at an intermediate level of access, and people with private insurance to have the best access. Of particular concern is the finding that Medicaid recipients were even more likely than uninsured respondents to report being denied care. Controlling for insurance generally attenuated the effect of income, except for preventive services. Interactions suggested that poorer respondents more than 30 years of age may have more access difficulties than others after insurance status is controlled for. ☐

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Cancer Incidence among American Indians and Alaska Natives, 1980 through 1987

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ABSTRACT

Objectives. This study uses Indian Health Service inpatient data to estimate cancer incidence among American Indians and Alaska Natives.

Methods. Hospital discharge data for 1980 through 1987 were used to identify cases of cancer for 21 sites in women and 18 sites in men. Estimates of incidence were directly standardized to data from the Surveillance, Epidemiology, and End Results Program for the same time frame.

Results. Cancers of the gallbladder, kidney, stomach, and cervix show generally high rates among many American Indian and Alaska Native communities, and cancers of the liver and nasopharynx are high in Alaska. Of the relatively common cancers in Whites, American Indians and Alaska Natives experience lower rates for cancers of the breast, uterus, ovaries, prostate, lung, colon, rectum, and urinary bladder and for leukemia and melanoma. Variation among geographic areas and among tribal groups is observed for many important cancer sites.

Conclusions. This study demonstrates significant variations of cancer rates among American Indians and Alaska Natives, with important implications for Indian Health Service cancer control programs. The study also supports the potential use of hospital discharge data for estimating chronic disease among diverse American Indian and Alaska Native communities. (*Am J Public Health.* 1993;83:1589–1598)

Introduction

Cancer incidence rates in American Indian and Alaska Native populations are generally considered to be lower than those in the general US population,[1–3] largely on the basis of regional studies from the New Mexico Tumor Registry,[2,4] Montana,[5] western Washington state,[6] northwestern Ontario,[7] Manitoba,[8] British Columbia,[9] and New York.[10] However, studies of cancer among Alaska Natives have shown generally higher rates,[11,12] and investigators in western Washington and Montana have found that tumor registry data systematically underestimate cancer rates in American Indians because of misclassification of numerator data.[5,13] Faced with the need to plan rational cancer control programs for a wide spectrum of American Indian and Alaska Native communities, the Indian Health Service requires a better understanding of variations in cancer rates among different populations. Unfortunately, no single study has examined cancer incidence rates across a broad cross section of US American Indian and Alaska Native populations using methods that compare rates in these populations with those in the general population or compare rates among groups of American Indians and Alaska Natives. Scattered reports from specific communities, however, suggest higher rates for certain cancer sites[5,7,10–12,14] and the strong possibility of substantial variation in rates among these populations, due in part to ethnicity, genetic stock, geography, and cultural and behavioral factors.[12,15–18]

This study examined hospital discharge data maintained by the Indian Health Service to describe the burden of cancer by sex and site for the areas covered by the service and for nine major tribal groups. Although discharge data are not population based and do not necessarily capture all incident cases presented to the health care system, they are readily available and potentially useful for surveillance of chronic disease. This study explored the use of discharge data for estimating cancer rates; thus, it represents an important beginning to the systematic study of cancer and its variation among

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American Indian and Alaska Native communities.

Background

A review of the literature of cancer in American Indians and Alaska Natives produced 22 nonduplicated, original reports of population-based studies conducted since 1970.[4–11,14,18–29] The results illustrate the variation in morbidity and mortality observed among different American Indian and Alaska Native populations studied to date. No population-based study has described cancer incidence in these populations with more than a regional scope.

The Indian Health Service provides direct care to approximately 1.1 million eligible American Indians and Alaska Natives.[30] The basic unit of operation for local health programs is the service unit, which integrates primary care and public health functions for a defined population and arranges for needed health care services not available in the local facility to be provided through contracts with providers in nearby metropolitan areas. The Indian Health Service operates 127 service units, with most located in the West and in Alaska. Of these units, 52 are operated by the local tribal authority on contract from the service. The Indian Health Service operates 43 hospitals, with another 7 operated by individual tribes. Management of the service units is coordinated by the following 12 regional administrative units, called Indian Health Service areas: Alaska, Albuquerque (New Mexico), Aberdeen (North Dakota, South Dakota, and Nebraska), Billings (Montana and Wyoming), Bemidji (Minnesota, Michigan, and Wisconsin), Portland (Oregon, Idaho, and Washington), Nashville (11 states east of the Mississippi River), Navajo (portions of Arizona and New Mexico), Oklahoma (Oklahoma, Kansas, and Texas), Phoenix (Arizona, Utah, and Nevada), Tucson (southern Arizona), and California. Hospital and outpatient care is also provided through contracts with local providers in instances in which service units are unable to provide needed services.

Methods

The Data Set

The Indian Health Service Inpatient Data System captures a standard data set for each patient discharged from a service or contract facility. All service and contract hospitals report to the system, with the exception of those in California and seven hospitals operated by contract to the local tribal authority. The latter include four hospitals in Alaska, one in Mississippi, and two in Oklahoma. Within the Nashville area, this exception in reporting left only the hospital serving the Eastern Cherokee in North Carolina. Since the Eastern Cherokee were included in the analysis by tribal group, the Nashville area was omitted from the analysis of Indian Health Service areas. Similarly, the California area, with no reporting hospitals, was not included. Finally, the Tucson area data were analyzed with those of the Phoenix area, since the Tucson area serves fewer than 20 000 individuals who share demographic and cultural characteristics with the service population of the Phoenix area. Consequently, data were examined for the populations served by nine Indian Health Service areas. Data reported for calendar years 1980 through 1987 were used in this analysis.

Estimation of Incident Cases

An algorithm was developed and tested to examine the data set and appropriately attribute multiple discharges to a single individual by means of social security number, sex, date of birth, community of residence, and hospital record number. In order to reduce the number of prevalent cases erroneously considered to be incident cases, another algorithm was developed to remove cases involving a site-specific cancer diagnosis in 1980 and 1981 from the estimates of incident cases for the study period 1982 through 1987. Thus, an incident case during the study time frame was identified as one involving an individual who had a site-specific cancer diagnosis during 1982 through 1987 with no cancer diagnosis at the same site in 1980 or 1981.

Rates were computed by Indian Health Service area and by nine major tribal groups. Rates computed by area were based on counts of incident cases attributed to a given area based on coded community of residence. Incident cases were attributed to a tribal group on the basis of both tribal affiliation code and community of residence at the time of initial cancer diagnosis. Patients living beyond the geographic area of the tribal organization were excluded from the tribal-specific analysis to maintain consistency with the denominator estimates, which were also based on tribal affiliation and place of residence (as described below).

Cancer sites were included in the analysis if their rate in either sex (directly age adjusted to the 1970 US population) was greater than 10 per 100 000 person-years or if other published studies had suggested an American Indian or Alaska Native rate significantly different from that in the non-Indian population. Consequently, the analysis considered 21 specific cancer sites in women and 19 in men.

Several sources of systematic error were considered in the estimates of incident cases. First, as noted above, four hospitals in the Alaska area and two in the Oklahoma area did not report inpatient discharge data. The populations served by the units that included the six hospitals were therefore omitted both from numerator counts and from the estimation of the population at risk. Second, it was believed that members of two service populations in the Northwest (Puget Sound and western Oregon) used non-Indian Health Service facilities; thus, these populations were omitted from the numerator and denominator estimates for the Portland area.

Other sources of systematic error were identified, but specific adjustments could not be made. For example, it is generally believed that American Indians and Alaska Natives in the Oklahoma area have better access to employer-based coverage of health services outside the Indian Health Service system. Also, inpatient data may not reflect care for some cancer sites, and these inconsistencies may vary by area as a result of differences in access and use of services as well as regional variation in practice patterns for cancer. Finally, there are probable sources of random error in the data as well, including errors in coding and data entry, as considered below.

Estimation of the Population at Risk

The population served by the Indian Health Service consists of all American Indians and Alaska Natives living on or near their reservation or formal seat of tribal government; this population was estimated to be just above 1 million in 1987.[30] The Indian Health Service population is considerably younger than the general US population. At the time of the 1980 census, the median age of American Indians and Alaska Natives was 22.6, compared with 30.0 for the US population. Approximately 32% of American Indians and Alaska Natives were less than 15 years old, and 5% were more than 64 years of age, compared with 23% and 11%, respectively, for the US population.[30]

Estimates of the denominator populations used to compute area and tribal rates were based on Indian Health Service

TABLE 1—Female Cancer in American Indians and Alaska Natives: Incidence Rates (95% Confidence Intervals) per 100 000 Population, by Indian Health Service Area

Cancer Site (ICD-9 Code)	SEER Whites	All Indian Health Service Areas	Aberdeen	Alaska	Albuquerque	Bemidji	Billings	Navajo	Oklahoma	Portland	Phoenix
Oral and pharynx (140.0–149.9)	6.5	3.0 (2.0, 3.9)	3.7 (0.0, 7.4)	13.1 (4.5, 21.6)	1.4 (0.0, 4.2)	0 . . .	4.6 (0.0, 9.8)	1.7 (0.1, 3.4)	2.5 (1.0, 4.0)	1.2 (0.0, 3.6)	2.4 (0.1, 4.7)
Salivary gland (142.0–142.9)	0.8	0.6 (0.2, 1.1)	0.9 (0.0, 2.7)	3.7 (0.0, 8.3)	1.4 (0.0, 4.2)	0 . . .	0 . . .	0.5 (0.0, 1.5)	0 . . .	0 . . .	1.3 (0.0, 3.0)
Nasopharynx (147.0–147.9)	0.3	0.7 (0.3, 1.2)	1.1 (0.0, 3.2)	5.6 (0.5, 10.7)	0 . . .	0 . . .	0 . . .	0.2 (0.0, 0.5)	0.5 (0.0, 1.1)	0 . . .	0.8 (0.0, 2.3)
Esophagus (150.0–150.9)	1.6	0.9 (0.3, 1.4)	1.1 (0.0, 3.2)	1.3 (0.0, 4.0)	0 . . .	0 . . .	0 . . .	0 . . .	1.3 (0.3, 2.4)	1.2 (0.0, 3.6)	1.3 (0.0, 3.0)
Stomach (151.0–151.9)	4.7	6.8 (5.4, 8.3)	9.0 (3.1, 14.9)	8.9 (1.8, 16.0)	18.6 (8.0, 29.2)	6.8 (0.0, 20.1)	5.0 (0.0, 10.0)	9.5 (5.6, 13.4)	3.9 (2.1, 5.8)	1.5 (0.0, 4.4)	5.6 (1.8, 9.4)
Colorectal (153.0–154.1, 159.0)	43.5	20.8 (18.2, 23.3)	16.4 (8.5, 24.3)	90.2 (66.8, 113.6)	22.0 (10.4, 33.7)	57.7 (22.5, 92.8)	19.2 (7.6, 30.8)	9.5 (5.7, 13.3)	18.5 (14.5, 22.6)	19.7 (9.1, 30.4)	13.1 (7.2, 19.1)
Liver (155.0)	1.2	2.0 (1.2, 2.8)	5.5 (1.1, 10.0)	7.2 (0.7, 13.6)	4.0 (0.0, 9.4)	0 . . .	2.0 (0.0, 5.9)	1.8 (0.2, 3.5)	0.7 (0.0, 1.5)	0 . . .	1.5 (0.0, 3.5)
Gallbladder (156.0)	1.4	7.1 (5.6, 8.6)	4.6 (0.6, 8.6)	14.4 (4.9, 23.9)	6.7 (0.1, 13.3)	5.3 (0.0, 15.8)	2.8 (0.0, 7.0)	9.6 (5.6, 13.6)	3.0 (1.4, 4.6)	5.6 (0.0, 11.2)	16.1 (9.7, 22.5)
Pancreas (157.0–157.9)	8.0	5.0 (3.8, 6.3)	10.5 (4.4, 16.7)	11.0 (3.1, 18.9)	5.8 (0.1, 11.6)	9.8 (0.0, 23.4)	4.0 (0.0, 9.5)	6.5 (3.2, 9.9)	2.1 (0.7, 3.5)	4.9 (0.0, 10.5)	3.9 (0.7, 7.2)
Lung and bronchus (162.2–162.9)	36.3	16.8 (14.5, 19.1)	32.1 (21.3, 43.0)	58.4 (40.8, 76.1)	12.1 (3.5, 20.6)	52.3 (18.0, 86.5)	37.8 (22.0, 53.5)	4.1 (1.4, 6.8)	12.1 (8.8, 15.4)	10.3 (2.6, 18.0)	10.9 (5.6, 16.1)
Melanoma of skin (172.0–172.9)	9.5	1.1 (0.6, 1.7)	0 . . .	3.2 (0.0, 7.8)	2.1 (0.0, 5.4)	0 . . .	0 . . .	1.0 (0.0, 2.3)	1.2 (0.3, 2.1)	3.0 (0.0, 7.2)	1.2 (0.0, 2.8)
Breast (174.0–174.9)	105.0	30.2 (27.2, 33.1)	46.7 (34.2, 59.3)	51.5 (35.9, 67.0)	19.5 (9.5, 29.4)	20.4 (0.6, 40.2)	42.2 (26.5, 58.0)	26.0 (19.8, 32.2)	30.9 (25.6, 36.1)	20.1 (9.2, 31.0)	18.8 (12.6, 25.0)
Cervix (180.0–180.8)	7.8	19.5 (17.2, 21.8)	23.5 (15.3, 31.6)	29.5 (18.3, 40.7)	31.3 (18.7, 43.9)	10.8 (0.0, 26.2)	32.3 (18.6, 45.9)	24.4 (18.5, 30.4)	11.4 (8.3, 14.5)	8.8 (2.7, 14.9)	20.5 (13.7, 27.2)
Corpus and uterus (179, 182–182.8)	23.3	7.4 (6.0, 8.9)	8.1 (2.7, 13.4)	1.4 (0.0, 4.3)	4.5 (0.0, 9.1)	3.3 (0.0, 9.9)	11.2 (2.8, 19.7)	3.7 (1.5, 6.0)	7.5 (4.9, 10.0)	8.5 (1.5, 15.4)	14.4 (9.4, 19.5)
Ovary (183.0)	14.3	9.9 (8.2, 11.6)	10.5 (4.2, 16.7)	14.6 (6.1, 23.2)	16.4 (6.8, 26.0)	0 . . .	18.3 (7.6, 28.9)	11.2 (7.0, 15.5)	7.1 (4.6, 9.6)	6.1 (0.6, 11.6)	9.6 (4.9, 14.4)
Urinary bladder (188.0–188.9)	7.7	1.3 (0.7, 1.9)	0.9 (0.0, 2.7)	4.2 (0.0, 9.1)	1.6 (0.0, 4.6)	6.8 (0.0, 20.1)	0 . . .	1.0 (0.0, 2.5)	1.5 (0.4, 2.6)	1.8 (0.0, 5.3)	0.3 (0.0, 0.7)
Kidney/renal (189.0–189.1)	5.4	5.4 (4.1, 6.6)	5.0 (0.6, 9.4)	17.0 (7.3, 26.8)	5.4 (0.1, 10.7)	9.0 (0.0, 21.9)	6.3 (0.1, 12.4)	8.4 (4.7, 12.1)	3.2 (1.5, 4.8)	2.4 (0.0, 6.1)	1.8 (0.0, 3.6)
Hodgkin's disease (201.0–201.9)	2.6	0.4 (0.0, 0.8)	0 . . .	0.5 (0.0, 1.5)	2.0 (0.0, 5.9)	0 . . .	0 . . .	1.0 (0.0, 2.5)	0.2 (0.0, 0.7)	0 . . .	0 . . .
Non-Hodgkin's (200.0–200.9, 202.0–202.9)	10.8	4.5 (3.4, 5.7)	8.6 (2.9, 14.3)	2.8 (0.0, 6.1)	4.3 (0.0, 9.3)	8.7 (0.0, 22.6)	4.2 (0.0, 9.2)	2.8 (0.7, 4.8)	4.7 (2.7, 6.7)	6.8 (0.8, 12.9)	3.0 (0.2, 5.8)
Multiple myeloma (203.0)	3.2	3.6 (2.5, 4.6)	3.2 (0.0, 6.8)	3.7 (0.0, 8.0)	5.6 (0.1, 11.1)	0 . . .	2.8 (0.0, 7.0)	4.6 (1.8, 7.3)	2.8 (1.2, 4.3)	2.8 (0.0, 6.8)	3.5 (0.6, 6.3)
Leukemia (204.0–208.9)	7.8	4.7 (3.6, 5.8)	6.9 (2.2, 11.6)	1.7 (0.0, 4.2)	7.2 (1.0, 13.3)	11.3 (0.0, 27.2)	8.2 (2.2, 14.1)	5.3 (2.7, 7.9)	2.2 (0.8, 3.5)	3.1 (0.0, 6.9)	5.8 (2.3, 9.4)
All sites (140.0–208.9)	334.5	173.2 (166.0, 180.3)	212.7 (185.6, 239.9)	355.6 (312.5, 398.8)	214.3 (179.4, 249.2)	214.9 (147.8, 282.0)	232.0 (194.6, 269.4)	170.3 (154.1, 186.6)	124.1 (113.7, 134.5)	132.2 (105.3, 159.0)	167.5 (148.0, 187.0)

Note. Rates have been directly standardized to the 1970 US population. ICD-9 = *International Classification of Diseases*, 9th edition; SEER = Surveillance, Epidemiology, and End Results Program.

population data derived by means of projection techniques from the 1980 census. Adjustments were made, however, to correspond to corrections required in the numerator estimates, as described above. Specifically, the service populations of the six units with hospitals not reporting to the data system (four in the Alaska area and two in the Oklahoma area) and the two units believed to be underused in the Portland area were omitted from the denominator populations.

For computation of tribal-specific rates, the population at risk was estimated from the number of individuals reporting a specific tribal affiliation in the 1980 census[31] and residing in counties overlapping traditional or current tribal land and in geographic proximity to the formal tribal government. The number of tribal members at risk were summed across the counties constituting the tribal area. For the Apache tribe, the Arizona communities of White River and San Carlos, as well as the New Mexico community of Mescalero, were aggregated. The Sioux consisted of the communities in North Dakota and South Dakota. The Tohono O'Odham/Pima consisted of the communities at Sells and Sacaton in Arizona. The Navajo consisted of the communities on the Navajo reservation in northwestern New Mexico and northeastern Arizona. The Eskimo, Aleut, and Athabascan were drawn from appropriate aggregations of the communities in Alaska. The Oklahoma Cherokee and Eastern Cherokee consisted of those individuals who resided in Oklahoma and North Carolina, respectively, and who identified themselves as Cherokee.

Computation and Comparison of Rates

Incidence rates for nine Indian Health Service areas and for nine major tribal groups were computed and directly adjusted by age and sex (in 5-year intervals) to the 1970 US population. Methods described by Armitage[32] were used to compute 95% confidence intervals for each rate, and rates were considered to differ if the confidence interval of one did not include the rates for the other. The principal analysis compared rates computed for nine Indian Health Service areas and nine major tribal groups with rates reported for US Whites in the Surveillance, Epidemiology, and End Results (SEER) Program during 1982 through 1987 (J. Hor[illegible], unpublished data, 1982–1987). A secondary analysis examined variation among the nine areas and the nine tribal groups.

Estimation of Error in the Data Set

In order to estimate the magnitude of random error in the data set, rates computed from the data set and from the New Mexico Tumor Registry were compared for the cancer sites and time frame used in this study. The tumor registry collects cancer cases from New Mexico and systematically includes American Indian and Alaska Native cases in Arizona reported by the Indian Health Service. This area is roughly equivalent to the areas of Albuquerque, Navajo, Phoenix, and Tucson. In the comparison, both tumor registry and inpatient data system cases were restricted to patients who resided in Indian Health Service areas within Arizona and New Mexico. A previous Indian Health Service Cancer Program study had corrected minor errors in the tumor registry data, largely involving racial misclassification of cases.

For comparison, rates from both data sets were adjusted by age and sex to the 1970 US population, and the rates from the Indian Health Service inpatient data system were compared with those derived from the tumor registry; the latter were considered the "gold standard." Ratios were constructed by dividing the Indian Health Service rate by the tumor registry rate. All ratios observed for both sexes fell within the range of 0.7 to 2.1, with 38.5% below and 53.8% above 1.0. The male and female ratios for all cancer sites combined were 0.96 and 0.85, respectively, and 88% of the site-specific ratios were between 0.70 and 1.25.

A second analysis was carried out to compare results reported here with the population-based studies reported by the New Mexico Tumor Registry for 1973 through 1981[4] and by Lanier et al. for 1969 through 1983.[11] Indirect standardization to the 1982 through 1987 SEER data for US Whites produced standardized incidence ratios that expressed the ratio of cancer cases observed to those expected if the study population experienced the same age- and sex-specific rates as the standard population. (Tables of the standardized incidence ratios for nine Indian Health Service administrative areas and nine major tribal groups are available on request from the authors.)

Results

The data set used in the analysis contained records of just over 760 000 discharges for the period [illegible] through [illegible]. There were 4387 cancer cases during the 1982 through 1987 time frame used to estimate incident cases.

Comparison with Rates in US Whites

Tables 1 and 2 show age- and sex-adjusted incidence rates for the aggregate Indian Health Service population and for the population served by each of the nine areas included in this study. The overall male and female cancer rates were significantly lower than the rates for US Whites. Men experienced increased rates of morbidity for cancers of the nasopharynx (1.5 per 100 000), kidney (8.4), and gallbladder (2.4), while women had an excess of cancers of the stomach (6.8), gallbladder (7.1), and uterine cervix (19.5). American Indians and Alaska Natives experienced lower rates for several cancer sites that occur with relative frequency in US Whites. Women had lower rates of breast, uterus, and ovary cancer; men had a lower rate of prostate cancer; and both men and women had lower rates of lung cancer, colon and rectum cancer, urinary bladder cancer, leukemia, and melanoma. In all Indian Health Service areas and for both sexes, with the exception of women in Alaska, the all-site rates were lower and ranged generally from 30% to 60% of the rates for US Whites.

Among women, several specific cancer sites were elevated relative to US White women. These included cancer of the nasopharynx (Alaska), stomach (Albuquerque and Navajo), gallbladder (Alaska, Navajo, and Phoenix), cervix (Aberdeen, Alaska, Albuquerque, Billings, Navajo, Oklahoma, and Phoenix), and colorectal, lung and bronchus, and kidney (Alaska). Among men, cancers of the nasopharynx, stomach, and liver were elevated in Alaska; gallbladder cancer was elevated in Navajo; and kidney cancer was elevated in Alaska and Navajo.

Consistent with the general belief of lower cancer incidence in American Indian and Alaska Native populations, a number of cancers were seen to be less common than in US White populations. Notably, many of the cancers that are relatively common in the general US population were observed to be lower in many Indian Health Service areas. Cancer of the lung and bronchus was less common among men in Aberdeen, Bemidji, and Billings and among both sexes in Albuquerque, Navajo, Oklahoma, Portland, and Phoenix. Cancers of both the breast and the corpus uterus were reduced among women in each of the nine Indian Health Service areas. Colorectal cancer

TABLE 2—Ma[redacted] Natives: Incidence Rates (95% Confidence Intervals) per 100 000 Population, by Indian Health Service Area

Cancer Si[redacted] (ICD-9 Co[redacted]	[redacted]	[redacted]	Aberdeen	Alaska	Albuquerque	Bemidji	Billings	Navajo	Oklahoma	Portland	Phoenix
Oral and phary[redacted] (140.0–149.9[redacted]	[redacted]	[redacted]	5.9 (1.4, 10.3)	16.5 (8.3, 24.8)	7.5 (1.6, 13.5)	11.8 (0.0, 28.0)	7.7 (0.9, 14.4)	5.4 (2.6, 8.1)	3.8 (1.9, 5.7)	2.7 (0.0, 6.3)	3.4 (0.6, 6.3)
Salivary gland (142.0–142.9[redacted]	[redacted]	[redacted]	1.0 (0.0, 2.9)	1.2 (0.0, 3.4)	1.4 (0.0, 3.3)	5.9 (0.0, 17.4)	0 . . .	0.4 (0.0, 1.1)	0.2 (0.0, 0.7)	0 . . .	1.3 (0.0, 3.1)
Nasopharynx (147.0–147.9[redacted]	[redacted]	[redacted]	0.4 (0.0, 1.3)	11.9 (4.8, 18.9)	1.9 (0.0, 4.7)	0 . . .	0 . . .	1.5 (0.1, 3.0)	0.5 (0.0, 1.2)	0 . . .	0 . . .
Esophagus (150.0–150.9[redacted]	[redacted]	[redacted]	1.8 (0.0, 4.3)	6.4 (0.8, 12.1)	5.6 (0.1, 11.2)	0 . . .	2.9 (0.0, 6.8)	0 . . .	3.5 (1.7, 5.4)	4.3 (0.0, 9.1)	1.8 (0.0, 3.8)
Stomach (151.0–151.9[redacted]	[redacted]	[redacted]	10.7 (4.7, 16.8)	24.4 (14.2, 34.7)	20.1 (9.6, 30.6)	5.9 (0.0, 17.4)	7.2 (0.8, 13.7)	10.3 (6.4, 14.2)	4.0 (2.1, 6.0)	9.4 (2.7, 16.1)	8.6 (4.1, 13.0)
Colorectal (153.0–154.1[redacted]	[redacted]	[redacted]	20.2 (11.6, 28.8)	50.6 (35.2, 66.0)	6.9 (1.4, 12.3)	58.0 (23.7, 92.3)	17.1 (7.1, 27.1)	8.2 (4.7, 11.7)	11.8 (8.4, 15.1)	14.2 (5.6, 22.8)	8.9 (4.3, 13.5)
Liver (155.0)	[redacted]	[redacted]	2.0 (0.0, 4.7)	9.2 (3.6, 14.8)	5.7 (0.1, 11.3)	7.6 (0.0, 18.9)	3.9 (0.0, 8.7)	3.6 (1.2, 5.9)	0.5 (0.0, 1.2)	1.4 (0.0, 4.2)	1.3 (0.0, 3.2)
Gallbladder (15[redacted]	[redacted]	[redacted]	2.9 (0.0, 6.3)	3.5 (0.0, 7.6)	6.1 (0.1, 12.1)	5.2 (0.0, 15.5)	1.6 (0.0, 4.7)	3.8 (1.4, 6.2)	0.5 (0.0, 1.2)	1.5 (0.0, 4.5)	3.8 (0.8, 6.9)
Pancreas (157.0–157.9[redacted]	[redacted]	[redacted]	5.8 (1.2, 10.4)	14.1 (6.3, 21.9)	5.6 (0.1, 11.1)	16.6 (0.0, 35.4)	5.3 (0.0, 10.6)	6.9 (3.7, 10.2)	3.8 (1.9, 5.7)	3.2 (0.0, 7.6)	3.8 (0.8, 6.8)
Lung and bron[redacted] (162.2–162.9[redacted]	[redacted]	[redacted]	46.2 (33.1, 59.2)	85.2 (65.6, 104.7)	14.4 (5.4, 23.4)	42.3 (12.9, 71.7)	56.4 (38.0, 74.9)	12.3 (8.0, 16.5)	28.4 (23.2, 33.6)	12.8 (5.0, 20.6)	6.3 (2.4, 10.3)
Melanoma of s[redacted] (172.0–172.9[redacted]	[redacted]	[redacted]	0 . . .	0 . . .	1.4 (0.0, 4.3)	7.7 (0.0, 19.5)	0 . . .	1.2 (0.0, 2.5)	1.7 (0.4, 3.0)	3.1 (0.0, 7.4)	0 . . .
Prostate (185.0[redacted]	[redacted]	[redacted]	30.9 (20.2, 41.6)	33.2 (20.6, 45.7)	34.3 (20.6, 48.1)	33.1 (6.6, 59.6)	43.0 (26.7, 59.4)	25.6 (19.6, 31.7)	20.5 (16.1, 25.0)	27.0 (14.5, 39.5)	14.4 (8.4, 20.5)
Urinary bladder (188.0–188.9[redacted]	[redacted]	[redacted]	4.8 (0.6, 9.0)	6.6 (1.2, 12.1)	5.5 (0.1, 10.9)	5.2 (0.0, 15.5)	6.5 (0.1, 12.9)	2.4 (0.5, 4.4)	4.3 (2.2, 6.3)	2.6 (0.0, 6.2)	0.3 (0.0, 1.0)
Kidney/renal (189.0–189.1[redacted]	[redacted]	[redacted]	7.3 (2.2, 12.4)	15.6 (7.1, 24.1)	9.9 (2.5, 17.2)	11.4 (0.0, 27.1)	7.5 (0.9, 14.0)	10.0 (6.2, 13.9)	6.1 (3.7, 8.5)	8.6 (1.6, 15.6)	8.0 (3.6, 12.2)
Hodgkin's dise[redacted] (201.0–201.9[redacted]	[redacted]	[redacted]	0 . . .	0.5 (0.0, 1.5)	0 . . .	4.3 (0.0, 12.6)	1.4 (0.0, 4.1)	0 . . .	0.3 (0.0, 0.7)	0 . . .	0 . . .
Non-Hodgkin's (200.0–200.9[redacted] 202.0–202.9)	[redacted]	[redacted]	4.2 (0.5, 7.8)	10.2 (3.6, 16.9)	7.4 (0.9, 13.9)	2.1 (0.0, 6.3)	4.4 (0.3, 8.5)	3.7 (1.4, 5.9)	3.5 (1.8, 5.3)	5.2 (0.4, 10.0)	3.5 (0.7, 6.3)
Multiple myelo[redacted] (203.0)	[redacted]	[redacted]	5.3 (1.0, 9.7)	3.7 (0.0, 7.9)	7.3 (0.9, 13.6)	4.3 (0.0, 12.6)	3.0 (0.0, 7.3)	3.7 (1.3, 6.2)	2.5 (0.9, 4.0)	2.7 (0.0, 6.6)	4.8 (1.4, 8.1)
Leukemia (204.0–208.9[redacted]	[redacted]	[redacted]	5.9 (1.7, 10.2)	3.0 (0.0, 6.3)	3.8 (0.6, 6.9)	7.8 (0.0, 19.3)	3.7 (0.0, 7.6)	4.9 (2.4, 7.3)	4.0 (2.2, 5.9)	1.8 (0.0, 3.6)	5.3 (2.2, 8.4)
All sites (140.0–[redacted]	[redacted]	[redacted]	174.8 (150.0, 199.6)	324.3 (286.8, 361.9)	170.8 (140.7, 200.9)	227.7 (160.8, 294.7)	174.7 (142.8, 206.5)	30.0 (116.4, 143.7)	107.7 (97.6, 117.7)	104.6 (81.4, 127.8)	93.2 (78.6, 107.9)

Note. Rates have[redacted] *International Classification of Diseases*, 9th edition; SEER = Surveillance, Epidemiology, and End Results Program.

rates were lower than those of US Whites for both sexes in Aberdeen, Albuquerque, Billings, Navajo, Oklahoma, Portland, and Phoenix. Cancer of the prostate was significantly lower in each area. Bladder cancer was lower in both sexes in all areas, with the exception of women in Alaska and Bemidji. While not common among US Whites, melanomas, leukemias, and non-Hodgkins lymphomas were even less common in most Indian Health Service areas.

Tables 3 and 4 compare cancer rates among nine tribal groups with those of US Whites and the aggregate Indian Health Service population. Consistent with the comparisons by area, the all-site rates were lower than those for US Whites, with the exception of Eastern Cherokee women and the three tribal groups of Alaska. All-site rates were higher for Eskimo and Athabascan women, lower for Eskimo men, and not substantially different from those of US Whites for Athabascan men and Aleuts of both sexes. For the other tribal groups, however, the all-site rates were lower than those for US Whites, ranging generally from 30% to 50% for men and 40% to 60% for women.

Cancer of the nasopharynx exceeded US rates for both sexes in the Eskimo and Athabascan populations and among male Aleuts, and salivary gland cancer was excessive in Athabascan and Aleut women. Cancer of the stomach was elevated in Eskimo men and Navajo women. Colorectal cancer was high in Eskimo women, and liver cancer was elevated among Eskimos of both sexes and among Sioux women. Gallbladder cancer dramatically exceeded US rates for Apache, Eskimo, and Tohono O'Odham/Pima women and for Navajos of both sexes, with rates ranging from 4 to 20 times those for US Whites. Interestingly, there appears to be a relative female preponderance (relative to US Whites) among most of the tribal groups for gallbladder cancer. Cervical cancer was elevated among Apache, Tohono O'Odham/Pima, Navajo, Sioux, and Eskimo women, ranging from 2.8 to 4.6 times the rates for US White women. Tohono O'Odham/Pima rates of cancer of the corpus uterus exceeded those of US White women, although lower rates were observed among all other tribal groups, consistent with the pattern noted for the areas.

As noted in the analysis of rates by area, many cancer rates by tribal group were less than those of US Whites. With the notable exception of Athabascan women, breast cancer rates were reduced among all tribal groups, ranging from 18% (Tohono O'Odham/Pima) to 55% (Sioux) of the White rates. Cancer of the lung and bronchus was generally below US White rates, except for similar rates among Eskimos of both sexes, Sioux women, and Athabascan and Aleut men. Rates exceeded those for US Whites, however, among Athabascan and Aleut women.

Variation among Indian Health Service Areas and Tribal Groups

Considerable variation was observed both among areas and among tribal groups for cancers of the oropharynx, nasopharynx, stomach, colon and rectum, liver, lung and bronchus, breast, cervix, uterus, and kidney and for cancers of all sites. Within the pattern of variation, there were relatively high rates in Alaska and relatively low rates in the Oklahoma and Navajo areas, also reflected in the tribal groups of the region.

Knowledge of variation is useful to support rational planning, development of clinical policies, and resource allocation across the diverse communities served by the Indian Health Service. The magnitude of variation observed among American Indian and Alaska Native populations is often dramatic. Relative to US White men, cancer of the liver was experienced only 18% as often in Oklahoma men and 50% as often by men in Portland and Phoenix; however, these rates ranged to three times the US White rate in Alaska. Lung cancer rates were 13 to 14 times higher among Alaska and Bemidji women than among Navajo women. There was a twelvefold difference in colorectal cancer rates between Eskimo and Tohono O'Odham/Pima women, a twenty-threefold difference in prostate cancer rates between Apache and Eastern Cherokee men, a twelvefold difference in stomach cancer rates between Portland and Albuquerque women, and a seventeenfold difference in leukemia rates between Eskimo and Tohono O'Odham/Pima women.

Comparison with Other Studies

In order to examine the precision of the judgments made in this study, we compared standardized incidence ratios computed from our data (available from the authors on request) with those reported from the New Mexico Tumor Registry for 1973 through 1981[4] and from an Alaska population-based study for 1969 through 1983.[11] The studies from the tumor registry were compared with our data for the Albuquerque area, although the tumor registry includes a substantial population of Navajos whose reservation extends into northwestern New Mexico. The data from Alaska were compared with our findings for the Aleut, Athabascan, and Eskimo populations, permitting comparison of results at the tribal-specific level.

Of the 16 cancer sites with standardized incidence ratios suggesting variation from US Whites found for the Albuquerque area, all were confirmed by studies from the tumor registry. Of the 27 cancer site variations from US Whites suggested by the standardized incidence ratios for the three tribal groups in Alaska, Lanier[11] reported significant findings for 21 (78%) and reported an observed-to-expected ratio in the same direction (more or less than 1.0) in 25 (93%). Our data suggested elevations of cancer rates for lung and ovary in Athabascan women not found by Lanier, although she projected a possible increasing trend in lung cancer from her 1968 through 1983 time frame.

Conversely, of the 40 findings reported from the New Mexico Tumor Registry,[4] we found 38 (95%) with standardized incidence ratios in the same direction. Data from the tumor registry suggested lower rates for cancer of the ovary and esophagus in men that were not confirmed by our data. However, the tumor registry included a substantial number of Navajos, and our data report a decrease in esophageal cancer for both the Navajo area and the Navajo as a tribal group. A similar decrease in cancer of the ovary (standardized incidence ratio = 0.7) was observed in Navajos. Of the 43 significant findings reported by Lanier[11] for the three tribal groups in Alaska, we found 36 (84%) with standardized incidence ratios in the same direction. Lanier reported elevations for cancer of the salivary gland in Eskimo women, cancer of the nasopharynx in Aleut women, cancer of the esophagus in Eskimo men, cancer of the gallbladder in Athabascan women, and multiple myeloma in Athabascan men, as well as a decrease in breast cancer in Athabascan women, that were not found in our data.

Discussion

This study confirms the impression of generally lower cancer rates among American Indians and rates among Alaskan Natives that approach those of the US general population. More important, however, is the demonstration of dramatic variation in cancer burden within the Indian Health Service population, as noted for leukemia, stomach, liver, lung, prostate, and colorectal cancers. These find-

TABLE 3—Female Cancer in American Indians and Alaska Natives: Incidence Rates (95% Confidence Intervals) per 100 000 Population, for All Indian Health Service Areas and Nine Major Tribal Groups

Cancer Site (ICD-9 Code)	SEER Whites	All Indian Health Service Areas	Apache	Eskimo	Tohono O'Odham/Pima	Navajo	Sioux	Oklahoma Cherokee	Athebascan	Aleut	Eastern Cherokee
Oral and pharynx	6.5	3.0	0	14.9	3.3	2.0	2.6	1.3	17.5	15.6	6.2
(140.0–149.9)		(2.0, 3.9)	. . .	(2.7, 27.0)	(0.0, 8.1)	(0.1, 3.8)	(0.0, 6.1)	(0.0, 3.0)	(0.0, 38.4)	(0.0, 46.1)	(0.0, 18.2)
Salivary gland	0.8	0.6	0	0	2.1	0.6	1.5	0	11.6	15.6	0
(142.0–142.9)		(0.2, 1.1)	. . .	. . .	(0.0, 6.2)	(0.0, 1.7)	(0.0, 4.4)	. . .	(0.0, 29.0)	(0.0, 46.1)	. . .
Nasopharynx	0.3	0.7	0	8.9	0	0.2	0	0.6	3.3	0	0
(147.0–147.9)		(0.3, 1.2)	. . .	(0.1, 17.7)	. . .	(0.0, 0.6)	. . .	(0.0, 1.9)	(0.0, 9.8)	. . .	. . .
Esophagus	1.6	0.9	3.0	2.4	3.1	0	1.7	0.6	0	0	0
(150.0–150.9)		(0.3, 1.4)	(0.0, 8.9)	(0.0, 7.0)	(0.0, 9.1)	. . .	(0.0, 5.1)	(0.0, 1.9)	. . .	. . .	. . .
Stomach	4.7	6.8	7.9	12.2	10.9	10.9	11.3	2.5	7.3	6.9	7.4
(151.0–151.9)		(5.4, 8.3)	(0.0, 17.0)	(0.7, 23.7)	(0.0, 22.1)	(6.5, 15.4)	(2.9, 19.7)	(0.1, 5.0)	(0.0, 21.5)	(0.0, 20.5)	(0.0, 21.8)
Colorectal	48.5	20.8	13.0	116.1	9.4	10.7	19.4	26.1	96.2	89.9	26.7
(153.0–154.1, 159.0)		(18.2, 23.3)	(0.1, 25.8)	(80.9, 151.3)	(0.0, 20.0)	(6.4, 15.0)	(8.7, 30.2)	(18.0, 34.2)	(31.9, 160.5)	(26.9, 152.9)	(0.0, 53.7)
Liver (155.0)	1.2	2.0	7.2	12.6	0	2.1	8.8	0	0	0	0
		(1.2, 2.8)	(0.0, 17.2)	(1.2, 23.9)	. . .	(0.2, 3.9)	(1.7, 15.9)	. . .	. . .	. . .	. . .
Gallbladder (156.0)	1.4	7.1	20.5	27.6	33.4	10.8	5.9	2.6	0	0	10.7
		(5.6, 8.6)	(5.0, 35.9)	(10.2, 44.9)	(13.5, 53.4)	(6.3, 15.4)	(0.1, 11.7)	(0.1, 5.1)	. . .	. . .	(0.0, 31.8)
Pancreas	9.0	5.0	3.9	2.4	3.4	7.4	13.4	2.6	34.0	36.4	7.4
(157.0–157.9)		(3.8, 6.3)	(0.0, 11.4)	(0.0, 7.0)	(0.0, 10.1)	(3.6, 11.2)	(4.5, 22.3)	(0.1, 5.2)	(0.0, 73.6)	(0.3, 72.5)	(0.0, 21.8)
Lung and bronchus	36.3	16.8	8.8	53.2	17.9	4.6	34.1	16.4	111.3	101.7	35.2
(162.2–162.9)		(14.5, 19.1)	(0.0, 17.7)	(30.5, 75.9)	(3.5, 32.3)	(1.6, 7.6)	(20.0, 48.1)	(10.0, 22.9)	(50.1, 172.4)	(37.2, 166.3)	(0.4, 69.9)
Melanoma of skin	9.5	1.1	0	5.6	2.3	1.1	0	2.3	0	0	0
(172.0–172.9)		(0.6, 1.7)	. . .	(0.0, 13.6)	(0.0, 6.9)	(0.0, 2.6)	. . .	(0.2, 4.4)	. . .	. . .	. . .
Breast (174.0–174.9)	105.0	30.2	26.2	50.7	18.5	28.7	57.9	37.7	106.1	40.1	43.9
		(27.2, 33.1)	(9.7, 42.8)	(30.4, 70.9)	(5.7, 31.3)	(21.8, 35.6)	(40.0, 75.7)	(28.0, 47.4)	(48.3, 163.9)	(0.0, 81.4)	(8.3, 79.6)
Cervix (180.0–180.9)	7.8	19.5	31.8	33.1	41.7	26.3	29.2	10.7	39.4	29.7	24.4
		(17.2, 21.8)	(14.1, 49.5)	(17.9, 48.3)	(21.5, 62.0)	(19.7, 32.8)	(17.7, 40.6)	(5.7, 15.7)	(4.1, 74.8)	(0.0, 61.9)	(0.0, 52.0)
Corpus and uterus	25.3	7.4	9.8	2.5	31.7	4.2	11.5	4.3	0	0	0
(179, 182–182.8)		(6.0, 8.9)	(1.0, 18.6)	(0.0, 7.5)	(26.4, 47.0)	(1.7, 6.8)	(3.4, 19.6)	(1.1, 7.5)	. . .	. . .	. . .
Ovary (183.0)	14.3	9.9	19.3	12.1	11.8	13.0	12.5	7.7	38.5	15.6	25.3
		(8.2, 11.6)	(4.6, 34.0)	(1.7, 22.6)	(0.7, 22.9)	(8.1, 17.9)	(3.7, 21.3)	(3.3, 12.1)	(6.8, 70.2)	(0.0, 46.1)	(0.0, 53.9)
Urinary bladder	7.7	1.3	0	2.1	0	1.2	1.5	1.2	13.4	7.6	0
(188.0–188.9)		(0.7, 1.9)	. . .	(0.0, 6.3)	. . .	(0.0, 2.8)	(0.0, 4.4)	(0.0, 2.8)	(0.0, 39.6)	(0.0, 22.5)	. . .
Kidney/renal	5.4	5.4	1.4	14.8	7.4	9.6	2.9	4.3	45.4	14.5	7.4
(189.0–189.1)		(4.1, 6.6)	(0.0, 4.1)	(2.4, 27.2)	(0.0, 15.9)	(5.4, 13.8)	(0.0, 6.9)	(1.1, 7.4)	(4.5, 86.2)	(0.0, 36.6)	(0.0, 22.0)
Hodgkin's disease	2.8	0.4	0	0.9	0	1.2	0	0	0	0	0
(201.0–201.9)		(0.0, 0.8)	. . .	(0.0, 2.5)	. . .	(0.0, 2.8)	. . .	. . .	. . .	. . .	. . .
Non-Hodgkin's	10.8	4.5	0	0.9	8.9	3.1	8.0	4.4	7.3	9.6	16.7
(200.0–200.9, 202.0–202.9)		(3.4, 5.7)	. . .	(0.0, 2.5)	(0.0, 19.2)	(0.8, 5.5)	(0.9, 15.1)	(1.2, 7.7)	(0.0, 21.5)	(0.0, 28.5)	(0.0, 39.9)
Multiple myeloma	3.2	3.6	2.3	4.0	7.6	5.5	5.1	3.9	0	0	10.7
(203.0)		(2.6, 4.6)	(0.0, 6.7)	(0.0, 9.6)	(0.0, 16.4)	(2.4, 8.7)	(0.0, 10.9)	(0.8, 7.0)	. . .	. . .	(0.0, 31.8)
Leukemia	7.8	4.7	2.9	0.8	14.1	5.6	7.3	3.1	8.2	0	20.2
(204.0–208.9)		(3.6, 5.8)	(0.0, 6.3)	(0.0, 2.4)	(1.4, 26.8)	(2.7, 8.5)	(1.1, 13.4)	(0.3, 5.8)	(0.0, 24.4)	. . .	(0.0, 43.4)
All sites (140.0–208.9)	324.5	173.2	202.1	402.5	279.0	191.5	286.9	150.2	553.9	459.5	283.9
		(166.0, 180.3)	(156.2, 248.1)	(341.0, 463.9)	(225.4, 332.6)	(173.2, 209.8)	(247.1, 326.8)	(131.1, 169.4)	(416.6, 691.3)	(323.7, 595.2)	(190.8, 377.0)

Note. Rates have been directly standardized to the 1970 US population. ICD-9 = *International Classification of Diseases*, 9th edition; SEER = Surveillance, Epidemiology, and End Results Program.

TABLE 4—Male Cancer in American Indians and Alaska Natives: Incidence Rates (95% Confidence Intervals) per 100 000 Population, for All Indian Health Service Areas and Nine Major Tribal Groups

Cancer Site (ICD-9 Code)	SEER Whites	All Indian Health Service Areas	Apache	Eskimo	Tohono O'Odham/Pima	Navajo	Sioux	Oklahoma Cherokee	Athabascan	Aleut	Eastern Cherokee
Oral and pharynx (140.0–149.9)	16.8	5.7 (4.4, 7.0)	12.4 (0.2, 24.6)	12.3 (2.8, 21.7)	7.4 (0.0, 16.3)	5.6 (2.6, 8.5)	6.2 (0.6, 11.9)	6.3 (2.2, 10.5)	21.3 (0.0, 45.3)	41.0 (4.9, 77.2)	7.9 (0.0, 23.4)
Salivary gland (142.0–142.9)	1.2	0.7 (0.2, 1.1)	0 . . .	0 . . .	6.1 (0.0, 14.7)	0.4 (0.0, 1.2)	0 . . .	0 . . .	0 . . .	9.2 (0.0, 27.1)	0 . . .
Nasopharynx (147.0–147.9)	0.6	1.5 (0.8, 2.1)	0 . . .	11.4 (2.1, 20.7)	0 . . .	1.7 (0.1, 3.3)	0.7 (0.0, 2.1)	0.7 (0.0, 2.1)	14.4 (0.0, 34.3)	25.3 (0.0, 53.9)	0 . . .
Esophagus (150.0–150.9)	5.2	2.7 (1.8, 3.6)	0 . . .	2.4 (0.0, 7.1)	0 . . .	0 . . .	0 . . .	5.0 (1.3, 8.7)	18.4 (0.0, 43.8)	18.3 (0.0, 43.7)	0 . . .
Stomach (151.0–151.9)	10.7	9.5 (7.8, 11.2)	13.4 (1.3, 25.5)	28.9 (13.9, 43.9)	12.2 (1.1, 23.3)	10.8 (6.5, 15.1)	11.3 (3.3, 19.2)	5.6 (1.7, 9.5)	15.3 (0.0, 37.0)	37.4 (4.1, 70.7)	9.7 (0.0, 28.6)
Colorectal (153.0–154.1, 159.0)	61.7	15.0 (12.9, 17.2)	9.3 (0.0, 19.9)	53.2 (32.7, 73.7)	1.3 (0.0, 3.8)	9.3 (5.3, 13.3)	24.7 (12.6, 36.8)	12.2 (6.4, 18.0)	40.4 (4.8, 75.9)	114.8 (47.3, 182.3)	33.5 (0.6, 66.5)
Liver (155.0)	2.8	2.6 (1.8, 3.5)	0 . . .	14.2 (5.2, 23.3)	5.8 (0.0, 13.7)	4.1 (1.4, 6.7)	1.5 (0.0, 4.6)	0 . . .	7.2 (0.0, 21.3)	0 . . .	0 . . .
Gallbladder (156.0)	0.8	2.4 (1.6, 3.3)	0 . . .	3.8 (0.0, 9.1)	5.3 (0.0, 12.8)	3.9 (1.3, 6.4)	4.7 (0.0, 10.0)	0 . . .	9.2 (0.0, 27.2)	0 . . .	0 . . .
Pancreas (157.0–157.9)	10.8	5.8 (4.4, 7.1)	3.3 (0.0, 9.7)	15.7 (4.6, 26.7)	0 . . .	7.9 (4.2, 11.5)	6.2 (0.1, 12.3)	5.0 (1.3, 8.7)	20.7 (0.0, 44.1)	16.4 (0.0, 39.2)	9.7 (0.0, 28.6)
Lung and bronchus (162.2–162.9)	82.5	27.8 (24.9, 30.8)	6.1 (0.0, 14.6)	106.1 (77.3, 134.8)	10.5 (0.2, 20.9)	13.1 (8.4, 17.9)	46.2 (29.7, 62.7)	35.0 (25.4, 44.8)	88.4 (36.3, 140.5)	92.3 (34.7, 149.8)	26.8 (0.0, 57.2)
Melanoma of skin (172.0–172.9)	12.3	1.1 (0.5, 1.7)	0 . . .	0 . . .	0 . . .	1.3 (0.0, 2.8)	0 . . .	2.9 (0.1, 5.7)	0 . . .	0 . . .	0 . . .
Prostate (185.0)	88.0	25.8 (22.9, 28.6)	3.3 (0.0, 9.7)	19.4 (6.7, 32.1)	29.7 (12.1, 47.4)	26.5 (19.9, 33.1)	32.5 (18.6, 46.3)	26.5 (18.1, 35.0)	91.8 (37.6, 146.0)	47.3 (5.7, 89.0)	74.8 (23.1, 126.4)
Urinary bladder (188.0–188.9)	31.7	3.8 (2.7, 4.9)	3.3 (0.0, 9.8)	5.4 (0.0, 11.7)	0 . . .	2.3 (0.3, 4.4)	3.2 (0.0, 7.5)	9.1 (4.2, 14.1)	17.1 (0.0, 40.8)	8.1 (0.0, 23.8)	9.2 (0.0, 27.3)
Kidney/renal (189.0–189.1)	5.4	8.4 (6.8, 10.0)	5.8 (0.0, 13.9)	20.8 (7.8, 33.8)	20.2 (6.2, 34.1)	10.9 (6.7, 15.2)	4.1 (0.0, 8.8)	3.6 (0.4, 6.8)	9.2 (0.0, 27.2)	19.9 (0.0, 47.4)	9.7 (0.0, 28.6)
Hodgkin's disease (201.0–201.9)	3.5	0.3 (0.0, 0.5)	0 . . .	0.9 (0.0, 2.6)	0 . . .	0 . . .	0 . . .	0.4 (0.0, 1.2)	0 . . .	0 . . .	0 . . .
Non-Hodgkin's (200.0–200.9, 202.0–202.9)	15.9	4.4 (3.3, 5.5)	5.8 (0.0, 13.9)	9.9 (1.7, 18.1)	3.3 (0.0, 9.6)	4.2 (1.6, 6.7)	3.1 (0.0, 6.8)	3.3 (0.6, 6.0)	27.5 (0.0, 56.6)	3.8 (0.0, 11.2)	0 . . .
Multiple myeloma (203.0)	4.7	3.8 (2.7, 4.9)	3.3 (0.0, 9.7)	4.4 (0.0, 10.6)	7.7 (0.0, 16.4)	4.2 (1.5, 7.0)	5.5 (0.0, 11.0)	0 . . .	0 . . .	9.2 (0.0, 27.1)	18.5 (0.0, 44.0)
Leukemia (204.0–208.9)	13.4	4.7 (3.6, 5.8)	3.1 (0.0, 9.0)	2.9 (0.0, 6.3)	12.4 (2.3, 22.5)	5.5 (2.7, 8.3)	6.7 (0.9, 12.5)	6.6 (2.7, 10.6)	9.2 (0.0, 27.2)	0 . . .	31.5 (0.0, 63.6)
All sites (140.0–208.9)	427.2	142.1 (135.6, 148.7)	108.3 (73.2, 143.3)	365.6 (313.0, 418.1)	149.0 (110.7, 187.3)	142.2 (127.0, 157.4)	203.8 (169.9, 237.7)	144.9 (125.3, 164.6)	419.9 (307.9, 532.0)	443.9 (320.2, 567.5)	298.2 (198.0, 398.5)

Note. Rates are directly standardized to the 1970 US population. ICD-9 = *International Classification of Diseases*, 9th edition; SEER = Surveillance, Epidemiology, and End Results Program.

ings underscore the danger inherent in generalizing health issues across the many distinct American Indian and Alaska Native communities and tribal groups.

Substantial variation may also be observed within an Indian Health Service area that is only apparent on tribal-specific analysis. For example, in the Phoenix area, cancer of the uterus is elevated among Tohono O'Odham/Pima women but lower among Apache women, with the elevation in the former not reflected in the relatively low rates for the Phoenix area. Cancers of the gallbladder and uterine cervix are consistently elevated across a broader range of Indian Health Service areas and tribal groups, and they appear to exceed US White rates in one or both sexes in Aberdeen, Alaska, Albuquerque, Navajo, Portland, and Phoenix. Nonetheless, variability in rates across areas is also apparent, with rates that cannot be distinguished from those of US Whites in Bemidji, Billings, and Oklahoma and rates that range upward to a tenfold elevation among women of Alaska and Phoenix.

Some caution is in order in interpreting the rates reported from this study. Discharge data probably underestimate some cancers that do not require hospitalization, and underuse of the Indian Health Service system may result in low estimates of community cancer care. The degree of underestimation may also vary by Indian Health Service area and by tribal group as a function of local service use and practice patterns. Finally, many of the incidence rates reported are based on relatively small numbers when disaggregated to the area or tribal level. Multiple comparisons are also a legitimate concern whenever so many different associations are considered. Nonetheless, the findings are useful in generating hypotheses for more detailed studies that could link Indian Health Service data with state cancer registry and vital data.[5]

For several cancer sites, further research would be particularly important to support cancer control programs. First, invasive cervical cancer rates exceed US rates in six Indian Health Service areas (ranging to 3.8 times the US rate in Alaska and Billings) and appear to actually exceed breast cancer rates in the Albuquerque and Phoenix areas. Prevention of invasive cervical cancer is well within the state of the art, and several research and demonstration projects are currently under way in the Indian Health Service to increase participation in cervical cancer screening programs. Cancer of the uterine corpus is elevated in Tohono O'Odham/Pima women and appears to be due to an excess of endometrial cancer. This finding has been discussed previously (J. Justice, unpublished data, 1974), and it certainly deserves more careful study to confirm the elevated rate and to examine potential risk factors. If the excess is confirmed, a program to alert women to the danger signs and need for screening would be appropriate. Dramatically elevated rates of cancer of the gallbladder are apparent in many American Indian and Alaska Native populations and have been shown to be associated with the presence of gallstones.[21,33,34] While standard screening procedures have not been tested for this cancer, the relatively high rates and generally poor outcome may stimulate research on strategies for prevention or early detection. It is interesting to speculate on the observation of no excess gallbladder cancer in two Cherokee populations that have been geographically separated for many generations. If confirmed by further study, this finding might provide the opportunity to study the relative effect of genetic and environmental factors on gallbladder cancer.

Cancer of the lung and bronchus has generally been lower among American Indians and Alaska Natives, presumably as a result of a nonsmoking tradition among many of these populations. Even so, lung cancer continues to be the most frequent cancer among American Indian and Alaska Native men and the fourth most frequent among women, trailing breast, colorectal, and cervical cancer. Moreover, our data suggest that lung cancer rates in women in Billings, Aberdeen, and Bemidji approach those of their White counterparts. Most alarming, however, is the evidence of high smoking rates among American Indian and Alaska Native adolescents[35] and young adults.[36,37] Programs targeting smoking cessation continue to be one of the most important cancer prevention strategies.

More difficult policy challenges confront the Indian Health Service in regard to several cancers that are less common in American Indian and Alaska Native communities, but for which current screening recommendations are based on the higher baseline rates of the general US population. In the face of the considerable deterioration in performance of screening tests that accompany lower population rates and the large number of serious health problems among American Indian and Alaska Native communities competing for limited health care resources, it is not clear that such recommendations should be applied uniformly. For example, rates of breast cancer in most Indian Health Service areas range from 18% to 50% of those in Whites. A recent Indian Health Service study examined the dramatically increased cost per breast cancer death prevented by screening mammography programs as a result of the relatively low incidence levels common to American Indian and Alaska Native populations.[38] A similar paradox exists in the cases of colorectal and prostate cancer, for which rates in many American Indian and Alaska Native communities are generally substantially lower than those in the US population. Coupled with substantial intertribal variation, such deviation from the rates of the US White population further stresses the need to match cancer control strategies to the rates observed in individual communities. The availability of better information on cancer incidence by community affords the opportunity to plan locally appropriate and cost-efficient methods for cancer surveillance.

Based on comparisons with existing studies of cancer in American Indian and Alaska Native populations, the Indian Health Service inpatient data set appears to be useful in estimating the variation of cancer incidence between these populations and US Whites and across relevant subsets of the service population. Several analyses have been conducted that support improvements in the quality of the data (S. Valway, unpublished data, 1989).[5,39] Similar rates and sources of error have been demonstrated in studies of cancer using discharge data in other settings as well.[40,41] Hospital discharge data, nonetheless, are generally believed to be useful for cancer surveillance,[40-42] particularly when accompanied by efforts to improve their quality.[43,44]

Summary and Conclusions

This study has demonstrated dramatic variation in cancer rates among the Indian Health Service areas and among nine major tribal groups. Such variation underscores the diversity among American Indian and Alaska Native groups and the need to target cancer control programs as a function of the epidemiology of preventable cancer. The impression that cancer rates are generally lower among American Indian and Alaska Native communities in the Southwest and that these rates approach those of US Whites in Alaska is generally confirmed. Rates among Eastern Cherokee women, however, also appear to approach those of

US Whites. Cancers of the gallbladder, stomach, and cervix show generally high rates among many American Indian and Alaska Native communities, and cancers of the liver and nasopharynx are high in Alaska. Conversely, several cancer sites that are relatively prevalent among US Whites (e.g., cancers of the breast, ovary, and uterus in women; prostate cancer in men; and colorectal cancer, lung and bronchus cancer, urinary bladder cancer, leukemia, and melanoma in both men and women) are less common. Finally, this study suggests that Indian Health Service inpatient data are useful in hypothesis-generating studies of rates and variations among American Indian and Alaska Native populations for chronic disease but that further attention to their quality may be necessary if they are to serve as an effective surveillance system. ☐

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Improving Response Rates through Incentive and Follow-Up: The Effect on a Survey of Physicians' Knowledge of Genetics

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ABSTRACT

Objectives. This study assessed efforts to increase response rates to a mailed physician survey and examined whether, as a result, nonresponse bias was reduced.

Methods. Randomly selected physicians and geneticists were mailed a questionnaire concerning genetics knowledge and attitudes. In the final but not the pilot survey, a $25 incentive and intensive follow-up were used to increase the response rate.

Results. The response rate from physicians in the final survey was 64.8% (n = 1140), compared with 19.6% in the pilot test (n = 69). Sample representativeness in sociodemographic and practice characteristics was improved by follow-up. Respondents recruited with more difficulty did not differ on the principal outcome variable, genetics knowledge, except on one subscore. Pilot study and final survey respondents did not differ in knowledge.

Conclusions. Although the effect of increased response rates on the principal outcome variable in this study was minimal, this may not be the case for other studies. Every effort should be made to attain as high a response rate as is practical and to establish that respondents are representative of the population being sampled. (*Am J Public Health.* 1993;83:1599–1603)

Introduction

Findings from surveys in which response rates are low are open to the criticism that they do not represent the entire population sampled. Increasing response rates may not, however, reduce nonresponse bias if the additional respondents resemble those easily recruited more than they resemble the remaining nonrespondents.[1–3] Differences between respondents and nonrespondents can still be found with moderately high (60% to 70%) response rates.[1,4] Others have concluded that with response rates of 75%, the bias introduced by differences between respondents and nonrespondents may be minimal.[5]

We obtained very low response rates in pilot testing a survey of physicians' knowledge and attitudes regarding human genetics. Consequently, extensive measures were taken to increase the response to the final survey, and a much higher response rate was achieved. This paper describes the steps taken to increase responses and examines whether the increase minimized response bias and affected the outcome variables of interest. Three questions were investigated: (1) Were there significant differences between respondents and nonrespondents to the final survey in sociodemographic and practice characteristics? (2) Did follow-up measures that brought in additional respondents improve sample representativeness and therefore alter the primary outcome variables? and (3) Did respondents to the final survey differ from pilot test respondents in their responses to the outcome variables? The answers to these questions have implications for choosing a cost-effective approach to surveying physicians. If respondents recruited with greater difficulty resemble other respondents more than they resemble nonrespondents and do not, therefore, reduce response bias, incentives and follow-up aimed solely at increasing response rates may not be effective.

Methods

Pilot Test

A questionnaire was developed by our team of geneticists and behavioral scientists. Revisions were made after each of two pretests, the first involving two local genetic counselors and four medical geneticists and the second involving a panel of 10 local primary care physicians.

The resulting questionnaire was pilot tested on a national sample consisting of 72 each of family physicians, internists, obstetrician-gynecologists, pediatricians, and psychiatrists. (From this point on, "physicians" refers to the above specialties but not to geneticists.) Physicians were randomly selected from the American Medical Association Physician Masterfile. Because we were more interested in determining what is currently being taught in medical schools, physicians in each specialty who graduated from medical school between 1971 and 1985 were sampled in a ratio of 2:1 relative to those who graduated between 1950 and 1970. A

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sample of 72 board-certified geneticists and genetic counselors was randomly selected from lists provided by the American Board of Medical Genetics.

The questionnaire was mailed to physicians accompanied by a letter from the principal investigator and a letter of support from the American Medical Association. In addition, letters of support were enclosed from the American Academy of Family Physicians, the American College of Physicians, the American Society of Internal Medicine, the Society of Perinatal Obstetricians, and the American Academy of Pediatrics in the mailing to physicians in the corresponding specialty. The geneticists' questionnaires were accompanied only by a letter from the principal investigator. Subjects were assured that after data collection was complete, their responses would be anonymous. A postcard reminder was mailed to all nonrespondents 2.5 weeks after the questionnaire mailing. The data collection process lasted approximately 2 months.

In order to assess the usefulness of offering 10 American Medical Association category 1 continuing medical education credits in the final survey as a response incentive, a random sample of half of the physicians in each specialty in the pilot sample were offered such credits for completing the questionnaire.

Final Survey

Questionnaire. The questionnaire was revised on the basis of an analysis of the pilot survey. The final version of the questionnaire could be completed by physicians in approximately 30 minutes. All questions, except for certain demographic questions, were in multiple choice format. Demographic, genetics knowledge, and opinion questions, as well as two psychometric scales, were included. It was the consensus of the developers that respondents who answered the knowledge questions correctly would be capable of explaining test results to their patients. A detailed description of the knowledge questions appears elsewhere,[6] and other analyses are in preparation.

Sample. The physician sample for the final survey was also selected from the American Medical Association Physician Masterfile. Physicians in only 10 states were sampled to make it easier to gain the help of local chapter chairs of medical specialty societies in improving response rates. One state was randomly selected from each of the 10 genetics network regions established by the Health Resources Administration of the US Department of Health and Human Services. The 10 states were New York, Illinois, Nebraska, Pennsylvania, Utah, Maine, Oregon, California, South Carolina, and Texas. Sampling in New York and California was limited (by random selection) to upstate areas and greater Los Angeles, respectively, in order to include only one chapter area per state for each specialty society. Physicians in each specialty were sampled in equal numbers from each state. In each state, physicians within each specialty who graduated between 1971 and 1985 were sampled in a ratio of 2:1 relative to those who graduated between 1950 and 1970. Participation was invited only from members or candidate members of the following societies (as determined by a search of the societies' directories): American Academy of Family Physicians, American College of Physicians, American College of Obstetricians and Gynecologists, American Academy of Pediatrics, and American Psychiatric Association. The final sample included 1795 physicians. (358 family physicians, 360 internists, 360 obstetrician-gynecologists, 359 pediatricians, and 358 psychiatrists). For comparison, 180 medical geneticists and 180 genetic counselors in the same 10 states were sampled from membership lists provided by the American Board of Medical Genetics. For states with 18 or fewer medical geneticists or genetic counselors, all names were selected. For the remaining states, 18 medical geneticists and 18 genetic counselors were randomly selected. For each state with fewer than 18, one geneticist was selected from each of the states with a surplus until 18 had been sampled.

Response incentives. Two incentives were offered to all physicians. First, respondents were offered a check for $25 on return of the completed questionnaire. Second, except for family physicians, respondents were offered 10 American Medical Association category 1 continuing medical education credits for completing the questionnaire and agreeing to review additional information sent afterward. The American Academy of Family Physicians agreed to award 7 prescribed continuing medical education credits to family physicians for the same activities. The prescribed credits are valuable to family physicians in terms of recertification.

Administration and follow-up. A number of additional measures were taken to achieve response rates for physicians higher than those obtained in the pilot test. Chapter chairs of the American Academy of Family Physicians, the American Academy of Pediatrics, and the American Psychiatric Association co-signed, with the principal investigator, the letter that accompanied the questionnaire to physicians in their chapters and also signed a postcard reminder. In some instances, the chapter chair included a personal note with the letter. The American College of Physicians agreed to have its president cosign the letters to internists. Consistent with its policy of limiting access to its membership for survey purposes, the American College of Obstetricians and Gynecologists declined to participate. Consequently, the president of the Society of Perinatal Obstetricians agreed to cosign all cover letters to obstetricians. As in the pilot study, subjects were assured that their responses would remain anonymous.

An "alert" postcard preceded the questionnaire mailing to physicians by 3 working days. Follow-up included a postcard reminder, phone calls from a survey research firm 2 weeks after the initial mailing, a second questionnaire mailing to physicians in specialties with response rates lower than 55% (family physicians, internists, and obstetricians), and a final round of phone calls to these physicians. Because no difficulty was anticipated in obtaining an adequate response from medical geneticists and genetic counselors, incentives were not offered to these subjects, and follow-up was limited to a postcard reminder. The entire data collection process lasted approximately 4.5 months.

Results

Response Rates

Questionnaires that for some reason did not reach the intended respondent (i.e., death, retirement, relocation) were not included in calculations of response rates. The average response rate for the pilot test from physicians was 19.6%. The highest response was from pediatricians, and the lowest rate was from obstetricians. A much higher response (74.6%) was obtained from geneticists (Table 1). With the exception of family physicians, the offer of continuing medical education credits did not affect the likelihood of response.

Physician response rates in the final survey were significantly higher than those in the pilot test (Table 1). The overall response rate for physicians was 64.8%. Again, the response from pediatricians was greater than from other specialties, and a high response rate (79.1%) was achieved for geneticists.

TABLE 1—Response Rates by Specialty: Pilot Test vs Final Survey

	Pilot Test			Final Survey		
Specialty	No. in Sample	No. Responding	Response Rate, %	No. in Sample	No. Responding	Response Rate, %
Family physician	71	13	18.3	347	215	62.0*
Internist	72	14	19.4	351	214	61.0*
Obstetrician/gynecologist	72	9	12.5	356	224	62.9*
Pediatrician	70	19	27.1	354	257	72.6*
Psychiatrist	67	14	20.9	351	230	65.5*
Total	352	69	19.6	1759	1140	64.8*
Medical geneticist	32	23	71.9	178	141	79.2
PhD geneticist	7	6	85.7	...	...	...
Genetic counselor	32	24	75.0	176	139	79.0
Total	71	53	74.6	354	280	79.1

*$P < .0001$ (chi-square test, pilot vs final response rate).

TABLE 2—Comparison of Respondents and Nonrespondents on Demographic and Practice Variables

	Respondents (n = 1140), %	Nonrespondents (n = 619), %	P^a
Sex			
Male	80.5	81.9	.48
Female	19.5	18.1	
Year of birth			
<1945	34.4	38.4	.001
1945–1951	33.8	38.0	
>1951	31.8	23.6	
US medical school graduate	86.7	77.2	<.00001
Year of graduation from medical school			
1950–1970	32.4	34.6	.001
1971–1977	31.2	37.3	
1978–1985	36.4	28.1	
Specialty			
Family physician	18.9	21.3	.008
Internist	18.8	22.1	
Obstetrician/gynecologist	19.6	21.3	
Pediatrician	22.5	15.7	
Psychiatrist	20.2	19.5	
Board certified	90.1	84.3	.0005
Major professional activity			
Office	77.4	81.4	.10
Hospital staff (including residents and fellows)	13.3	10.5	
Research	3.9	2.4	
Other	5.4	5.7	
Present employment			
Solo/2-physician practice	37.4	43.9	.03
Group practice	30.1	27.6	
Other	32.5	28.4	

^{a}By chi-square test.

Respondents vs Nonrespondents: Final Survey

Information included on the American Medical Association Physician Masterfile was used to compare physician respondents and nonrespondents in the final survey by chi-square analysis. Six of eight demographic and practice variables differed significantly at $P < .05$ (Table 2). Respondents were more likely than nonrespondents to be younger than 40, to have graduated from US medical schools, to have graduated from medical school after 1977, and to be board certified; they were less likely to be in practice by themselves. Pediatricians were more likely to respond than physicians in other specialties. For variables that showed a significant difference overall between respondents and nonrespondents, the trend remained the same when analyzed by specialty, although the level of significance varied.

A logistic regression with respondent vs nonrespondent as the dependent variable was performed to adjust for confounding among the practice variables. Attending a US rather than foreign medical school was the most important predictor, with US medical school graduates being more than twice as likely to respond as foreign medical graduates (OR = 2.158, $P < .0001$). Year of graduation, specialty, and board certification were independently related to the likelihood of response. Other variables were not significant.

Effect of Additional Respondents on Sample Representativeness

Of the physicians, 23.5% responded within 3 working days of the postcard reminder mailing ("early" group) and 18.8% responded within 5 days of the first telephone follow-up ("middle" group). An additional 22.5% responded before termination of data collection ("late" group).

Comparisons by length of time taken to return the questionnaire are presented in Table 3. Significant differences between early, middle, and late respondents were found for several demographic and practice variables. A stepwise multiple regression with number of days to respond as the dependent variable was performed to adjust for confounding among the variables associated with response time. Specialty, US medical school, race, and importance of attending religious services accounted for 6% of the variance in response time. Academic appointments did not enter the regression equation.

No differences were found between early, middle, and late respondents on questions related to genetics training and experience and attitudes toward genetics. An overall genetics knowledge score was created by assigning one point for each correct answer (one 4-part question was assigned one-fourth point for each correct answer), for a possible total score of 26. Concepts (maximum score = 17) and facts (maximum score = 9) subscores were also computed.[6] The overall score

TABLE 3—Comparison of Early, Middle, and Late Respondents on Demographic and Practice Variables

	Initial Sample[a] (n = 1759), %	Respondent Group Early (n = 414), %	 Middle (n = 331), %	 Late (n = 395), %	P[b]
Sex					
Male	81.0	80.7	80.1	80.8	.97
Female	19.0	19.3	19.9	19.2	
Year of birth					
<1945	35.8	34.8	31.7	36.2	
1945–1951	35.2	31.9	35.3	34.4	.56
>1951	28.9	33.3	32.9	29.4	
Race/ethnic group					
White		93.2	87.9	85.5	
Black		0.7	2.1	1.5	
Hispanic		0.5	1.5	3.1	.008
Asian		4.9	8.2	9.7	
Other		0.7	0.3	0.3	
US medical school graduate	83.3	90.6	86.1	83.0	.006
Year of graduation from medical school					
1950–1970	33.1	32.4	32.6	32.2	
1971–1977	33.4	30.9	31.1	31.6	.999
1978–1985	33.5	36.7	36.3	36.2	
Specialty					
Family physician	19.7	17.1	18.4	21.0	
Internist	20.0	19.8	11.5	23.8	
Obstetrician/gynecologist	20.2	21.0	14.8	22.3	<.00001
Pediatrician	20.1	22.7	29.9	16.2	
Psychiatrist	20.0	19.3	25.4	16.7	
Board certified	88.1	90.3	89.4	90.4	.89
Academic appointment		56.9	55.0	48.1	.03
Major professional activity					
Office	78.8	77.5	74.0	80.0	
Hospital staff (including residents and fellows)	12.3	11.4	16.0	13.2	.09
Research	3.4	3.6	4.5	3.5	
Other	5.5	7.5	5.4	3.3	
Present employment					
Solo/2-physician practice	39.7	35.5	35.6	40.8	
Group	29.2	31.6	28.4	29.9	.30
Other	31.1	32.9	36.0	29.4	
Health maintenance organization affiliation		39.3	45.5	43.7	.21
Importance of attending religious services					
Very unimportant–important		83.2	78.7	76.0	.04
Very important		16.8	21.3	24.0	

[a] Respondents and nonrespondents.
[b] Chi-square test, early vs middle vs late.

TABLE 4—Comparison of Genetics Knowledge Scores for Early, Middle, and Late Respondents

Score	Respondent Group, Mean ± SD Early (n = 414)	 Middle (n = 331)	 Late (n = 395)	F
Concepts	13.3 ± 2.6	13.1 ± 2.7	12.8 ± 2.7	4.30[a]
Facts	6.1 ± 1.9	6.1 ± 1.8	6.2 ± 1.8	0.33
Total	19.4 ± 3.6	19.1 ± 3.6	18.9 ± 3.6	1.83

[a] P = .01.

did not differ significantly by response time. However, late respondents scored significantly lower than early respondents on the concepts subscore (Table 4). A hierarchical multiple regression with the concepts score as the dependent variable was performed to determine whether response time was independently related to the concepts score. Specialty, US vs foreign medical school attendance, academic appointments, and race, entered as predictors in block 1, accounted for 12.3% of the variance in the concepts score. Response time, entered in block 2, accounted for an additional 0.4% ($P < .05$) of the variance in the concepts score after the other variables had been entered.

Pilot Test vs Final Survey Respondents

Respondents to the pilot test were more likely than were final survey respondents to state that it is important (51.5% vs 43.5%) or extremely important (47.1% vs 39.3%) to attempt to detect actual or potential genetic disorders (chi-square test, $P = .0002$). Scores designed to compare the knowledge of physicians who responded to the pilot test and the final survey were created by totaling the number of correct responses for 20 knowledge questions (12 concepts questions and 8 facts questions) appearing on both the pilot test and final questionnaires. Neither the overall knowledge score nor the two subscores differed significantly between pilot test and final survey respondents. However, obstetricians in the pilot test scored almost two points higher in overall knowledge than those in the final survey. This difference was not statistically significant because of the small number of obstetricians in the pilot test. Obstetricians in the pilot test did not differ significantly from geneticists in knowledge.

Discussion

The dramatic increase in the physician response rate from the pretest to the final survey is attributable to a combination of incentives and follow-up. As has been shown previously in surveys of physicians,[4,7] the monetary incentive was an important factor. The offer of continuing medical education credits was not as effective overall but contributed to the response rate of family physicians, for whom such credits are important for recertification. Repeated follow-ups elicited a gradual increase in response. In summary, response rates can be improved in mail surveys of physicians when incentives and persistent follow-up are used.

Certain groups of respondents were more difficult to recruit. Foreign medical school graduates were less likely to respond than were US graduates, as has been found in previous research.[1] With protracted efforts, a higher proportion of responses from foreign medical school graduates was obtained. Therefore, follow-up did improve sample representatives. Nevertheless, differences between respondents and nonrespondents in sociodemographic and professional characteristics remained. Although statistically significant, these differences were relatively small in magnitude. In surveying physicians, efforts should be directed at obtaining responses from groups that are typically difficult to recruit, such as foreign medical school graduates.

For pilot test respondents, the perceived importance of detecting genetic disorders was higher than for respondents to the final survey. In the absence of incentives, we believe that respondents to the pilot survey were more likely to be motivated by belief in the importance of genetics than were nonrespondents. This can contribute to response bias, as was probably the case for obstetricians in the pilot test whose knowledge scores were not significantly different from those of geneticists.

Changes in response rates in the final survey had minimal impact on the primary dependent variable of genetics knowledge. A small difference between early and late respondents was found for one knowledge subscore. Although the effect of increased response rates on the principal outcome variable in this survey was minimal, this may not be the case in studies of other topics. Therefore, every effort should be made to attain as high a response rate as is practical and to establish that respondents are representative of the population being sampled. ☐

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Weapon Carrying among Inner-City Junior High School Students: Defensive Behavior vs Aggressive Delinquency

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ABSTRACT

Objectives. The purpose of this study was to estimate associations between beliefs and experiences hypothesized to be related to weapon carrying among youths.

Methods. Students in two inner-city junior high schools completed anonymous questionnaires. Logistic regression models were fit for having ever carried a weapon for protection or use in a fight and were stratified by sex and weapon type.

Results. Among males, 47% had carried knives and 25% had carried guns. Key risk factors for knife carrying were being threatened with a knife, getting into fights, and disbelief that having a weapon increases the carrier's risk of injury. Gun carrying was associated with having been arrested, knowing more victims of violence, starting fights, and being willing to justify shooting someone. Among females, 37% had carried a knife; knowing many victims of violence and being willing to justify shooting someone predicted knife carrying.

Conclusions. Knife carrying was associated with aggressiveness but did not appear to be related to serious delinquency. Gun carrying within this nonrandom sample appeared to be a component of highly aggressive delinquency rather than a purely defensive behavior. (*Am J Public Health.* 1993;83:1604–1608)

Introduction

Weapon-related violence is a major health problem among adolescents in the United States. Homicide is the second leading cause of death for youths aged 15 through 19 years. Almost half of the Black males aged 15 through 19 who died in the United States in 1989 were murdered, typically with a gun.[1] Of the 2771 homicide victims aged 10 to 19 years in 1989, 80% were killed with guns and 10% were stabbed to death.[1] Firearm homicide rates for Black males aged 10 through 19 years increased by 140% from 1979 to 1989.[1,2]

Youths are often perpetrators of violence as well as its victims. Nationwide, 17% of all persons arrested for violent crimes in 1991 were younger than 18 years of age.[3] Juvenile arrests for serious violent offenses have increased dramatically since the mid-1980s; these increases have coincided with a sharp rise in juvenile arrests for weapon carrying.[4]

A higher incidence of gun carrying among youths has been implicated as a key factor contributing to recent increases in youth violence.[4] National survey data on high school students revealed a monthly prevalence of weapon carrying of 20% in 1990.[5] Weapon carrying prevalence was highest among Black (39%) and Hispanic (41%) males. Twenty-one percent of Black males reported that they had carried a gun over the past month. A recent survey conducted in 10 selected inner-city high schools in four states found that 35% of male students and 11% of female students reported carrying a gun.[6]

Because weapon carrying can increase risks both to the individual carrying the weapon[7,8] and to others,[9] reducing weapon carrying among adolescents is among the national health objectives for the year 2000.[10] Yet little is known about the determinants of weapon carrying among adolescents. Data from a survey of inner-city high school students in the Midwest[11] and a focus group study in Dade County, Florida,[12] suggest that gun carrying is motivated by a belief that carrying a gun provides protection against being "jumped." Other studies have found weapon carrying among youths to be highly correlated with serious criminal activities.[6,13,14]

In the present study we assess the relationship between weapon carrying and a variety of personal factors hypothesized to be related to weapon carrying within a nonrandom sample of students attending two public junior high schools in Washington, DC. Weapon carrying was hypothesized to be a function of seven related factors: (1) first- and second-hand exposure to violence; (2) delinquent activities; (3) beliefs about the acceptability of hitting someone under certain conditions; (4) beliefs about the acceptability of shooting someone under certain conditions; (5) perceived peer support of violence; (6) aggressive behavior patterns; and (7) the belief that having a weapon can provide effective protection against an attack.

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Methods

Study Participants and Data Collection

As part of a larger study to evaluate the effects of a youth violence prevention program, baseline data were collected in two public junior high schools in Washington, DC. In school A, seventh-grade students enrolled in compulsory drug education classes were surveyed in the spring and fall of 1991. Students in school B were enrolled in eighth-grade social studies classes and were surveyed in the fall of 1991. School A is located in the central part of the city, an area that has a relatively high crime rate. School B is located in the southeastern part of the city, which has the highest concentration of poverty and crime. More than 95% of the students in each school were Black.

Students were instructed not to write their names on the questionnaires to protect the anonymity of their responses and were assured that only the research team would see their responses. In the classroom, as students read and completed the questionnaires, each question was read aloud by a member of the research staff.

Measures

The prevalence and frequency of weapon carrying was assessed with two sets of nested questions. For both guns and knives, students were asked, "Have you ever carried a gun (knife) with you for protection or to use in case you get into a fight? If your answer is yes, how many times would you say that you carried a gun (knife) for protection during the past 2 weeks?"

Three of the hypothesized risk factors for weapon carrying were measured by scales. The Hitting Acceptable scale was based on the sum of three attitudinal items, each with a 6-point Likert-scale response indicating level of agreement or disagreement with a statement pertaining to circumstances under which hitting someone was justified. The Shooting Acceptable scale was the sum of the responses to two items concerning conditions under which shooting someone was believed to be justified. A third scale, Image/Norms, included six items related to concerns about self-image and perceived peer norms pertaining to aggression. The internal consistency of these attitudinal scales was generally good (Hitting Acceptable $\alpha = .74$, Shooting Acceptable $\alpha = .55$, Image/norms $\alpha = .78$).

Data Analysis

Bivariate associations between ever having carried a weapon and dichotomous independent variables were measured by unadjusted odds ratios for which 95% confidence intervals were calculated. Differences in means for continuous independent variables were assessed by means of Student's t test.

Logistic regression analysis was used to assess the effects of each independent variable while controlling for other variables in the models. Interaction terms were included in the model if there was some theoretical rationale for the interaction and if the Wald statistic for the term was significant at the .05 level.

Three measures of model fit were used: the deviance statistic (D), the Pearson chi-square goodness-of-fit statistic (GOF χ^2), and Hosmer and Lemeshow's G^*_y statistic.[15,16] Model coefficients, B_i, were transformed (e^{B_i}) so that they could be interpreted as adjusted odds ratios, and 95% confidence intervals were calculated for each e^B. Each variable's contribution to the prediction of weapon-carrying status was measured by the partial correlation coefficient R.

Results

Profile of Respondents

Data on knife or gun carrying were available for 294 of the 295 respondents, all of whom were Black. Compared with respondents in school B, school A respondents were 1 year older on average (mean = 14.2 years, range = 12.9–16.7, vs mean = 13.3 years, range = 11.1–16.0; $t = 5.78$, $P < .001$) and somewhat less likely to live with their father or stepfather (27% vs 39%, $\chi^2 = 2.23$, $df = 1$, $P = .14$).

Prevalence and Frequency of Weapon Carrying

Nearly half of the males reported carrying knives for protection or to use in case they got into a fight (Table 1). The prevalence of ever carrying a gun among males was 23% in school A and 40% in school B. Knife carrying was also more prevalent among females in school B (67%) than in school A (31%).

Because the difference in the frequency of weapon carrying between schools among those who reported they had carried a weapon was not statistically significant, frequency data were combined across schools (Table 2). One of every five knife carriers carried a knife on a routine basis (from 8 through 14 days during the previous 2 weeks), whereas 16% of male gun carriers carried guns routinely.

TABLE 1—Percentage of Students Reporting Ever Having Carried a Weapon for Protection or for Use If in a Fight, by Sex, Grade, and Weapon Type

		Knife		Gun	
Grade	School	%	n	%	n
Males					
Seventh	A	48	66/138	23	32/141
Eighth	B	45	9/20	40	8/20
Females					
Seventh	A	31	35/112	4	5/112
Eighth	B	67	14/21	5	1/21

TABLE 2—Frequency of Reported Weapon Carrying Over Previous 2 Weeks, by Sex and Weapon Type, among Students Who Had Ever Carried a Weapon for Protection

	No. Days							
	0		1–3		4–7		8–14	
	%	n	%	n	%	n	%	n
Carried knife								
Males	21	15	34	25	26	19	19	14
Females	15	7	53	25	11	5	21	10
Carried gun								
Males	26	10	37	14	21	8	16	6

Bivariate Associations

Among males, having been arrested, having been threatened or attacked with a weapon, and getting into fights were all associated with increased odds of having carried a knife (Table 3). Lack of belief that weapon possession increases one's risk of being injured or killed, evident in 55% (87/157) of male respondents, was associated with knife carrying. Compared with other males, those who had carried knives knew more people who had been injured or killed by violence (mean = 6.7 vs 4.2, $t = 2.08$, $P = .04$). Males who carried knives had higher scores on the Hitting Acceptability scale ($t = 2.92$, $P = .004$), but did not differ from other males on either the Shooting Acceptability scale ($t = 0.33$, $P = .74$) or the Image/norms scale ($t = 1.55$, $P = .12$).

TABLE 3—Bivariate Associations between Ever Having Carried a Knife and Experiences with Violence, Seventh- and Eighth-Grade Males

	Ever Carried Knife		Odds Ratio	95% Confidence Interval
	%	n		
Ever been arrested				
Yes	66	25/38	2.73	1.28, 5.85
No	41	50/121		
Been threatened/attacked with knife				
Yes	74	34/46	4.89	2.27, 10.50
No	37	40/109		
Been threatened/attacked with gun				
Yes	65	26/40	2.71	1.29, 5.70
No	41	48/118		
Fought in past 4 weeks				
Yes	67	29/43	3.22	2.21, 4.70
No	39	45/115		
More likely than classmates to fight				
Yes	63	32/51	2.51	1.26, 4.99
No	40	43/107		
Start fights				
Yes	42	8/19	0.83	0.31, 2.19
No	47	64/137		
Believe having a weapon increases injury risk				
Yes	34	24/70	0.39	0.20, 0.75
No	58	50/87		

TABLE 4—Bivariate Associations between Ever Having Carried a Knife and Experiences with Violence, Seventh- and Eighth-Grade Females

	Ever Carried Knife		Odds Ratio	95% Confidence Interval
	%	n		
Ever been arrested				
Yes	75	9/12	6.56	1.68, 25.56
No	31	38/121		
Been threatened/attacked with knife				
Yes	73	19/26	7.56	2.87, 19.91
No	26	28/106		
Been threatened/attacked with gun				
Yes	71	12/17	5.65	1.84, 17.27
No	30	34/114		
Fought in past 4 weeks				
Yes	68	21/31	6.38	2.65, 15.37
No	25	25/101		
More likely than classmates to fight				
Yes	66	21/32	5.51	2.34, 12.96
No	26	26/101		
Start fights				
Yes	38	3/8	1.09	0.25, 4.78
No	35	44/124		
Believe having a weapon increases injury risk				
Yes	32	20/62	0.74	0.36, 1.52
No	39	27/69		

The same general pattern of bivariate associations with knife carrying emerged for females and males; however, these associations were somewhat stronger for females (Table 4). The exception to this pattern was a lack of association between knife carrying and belief that having weapons increases one's risk of being injured or killed. On average, females who carried knives knew more than twice as many victims of violence as did other females (mean = 7.9 vs 3.5, $t = 4.85$, $P < .001$). In addition, females who carried knives had higher scores on the three attitudinal scales.

The odds of ever having carried a gun were 7.7 times higher among males with an arrest history (weapon-carrying offenses excluded) than among males who had never been arrested (Table 5). All nine males who had been arrested for drug violations reported having carried a gun. A tendency to fight, including starting fights, was also related to having carried a gun, as was having been threatened or attacked with a gun. Males who carried guns knew more victims of violence than did males who did not carry guns (mean = 9.53 vs 4.44, $t = 2.82$, $P = .007$). Gun carriers also had higher scores on all three attitudinal scales.

Multivariable Analysis

The adjusted odds ratios derived from the logistic regression models for having carried a knife are presented in Table 6. For males, the strongest predictors for having carried a knife were having been threatened or attacked with a knife, disbelief that having weapons increases injury risks, and being more likely than classmates to get into fights but not usually being the one to start fights.

Estimates from the model for having carried a knife were markedly different for females. The 95% confidence limits for the adjusted odds ratios for only two predictors did not include 1.0. Belief in the acceptability of shooting someone under certain circumstances was the strongest predictor of knife carrying among females. After the other factors in the model were controlled for, each additional victim of violence known by the respondent was associated with a 19% increase in the odds of knife carrying.

Having been arrested was the single best predictor of having carried a gun for males (Table 7). The odds of having carried a gun were considerably elevated among males reporting the most aggressive behavior patterns (i.e., being more likely than classmates to participate in and to initiate fights). Believing that shooting someone is justifiable under certain circumstances and perceiving peer acceptance of violence were also positively associated with gun carrying. After other factors in the model were controlled for, neither having been threatened or attacked with a gun nor disbelief that having a weapon increases injury risk was significantly related to gun carrying. (Note: One case was removed from the model because of the extreme effect it had on the estimates and the model's fit. The case removed was a respondent who reported having carried a gun, but had never been arrested or threatened with a gun, and who was less inclined to get into or start fights. Removing this case improved the fit of the model dramatically. For example, the G^*_y for the model with the outlier was 25.10 (df = 11, p = .01) compared to 4.96 (df = 11, p = .93) without the outlier. Most estimates increased when the case was removed.)

Discussion

Weapon carrying was alarmingly common among this convenience sample of inner-city seventh- and eighth-grade students. Our findings indicate that risk factors for weapon carrying varied by sex and weapon type. Among males, knife carrying was strongly related to aggressive behavior tendencies and the belief that having a weapon does not increase one's risk of being injured by violence. Having been threatened or attacked with a knife was an important predictor of knife carrying among males. This may be more indicative of respondents' propensity to get into fights with others who carry knives than of random victimization.

The beliefs and behaviors of males who carried knives tended to be aggressive; unlike gun carriers, however, they were not at the outer extremes on these measures. Gun carrying was also strongly linked with indicators of serious delinquency. Most males who had been arrested had also carried a gun and all who had been arrested on drug-related charges had carried a gun. The associations between gun carrying and the number of victims of violence known, and the perception of peer support for violence, suggest that gun carrying is partially determined by the degree to which a youth's social network is involved in, and supportive of, violence. These socioenvironmental factors are also likely to support the most extreme attitudes and behaviors related to violence that legitimize gun carrying and use. Willingness to justify shooting someone and a tendency to start fights are examples.

TABLE 5—Bivariate Associations between Ever Having Carried a Gun and Experiences with Violence, Seventh- and Eighth-Grade Males

	Ever Carried Gun		Odds Ratio	95% Confidence Interval
	%	n		
Ever been arrested				
Yes	57	21/37	7.73	3.51, 17.51
No	14	18/124		
Been threatened/attacked with knife				
Yes	33	15/45	2.05	0.94, 4.44
No	20	22/112		
Been threatened/attacked with gun				
Yes	44	17/39	3.26	1.67, 8.10
No	17	21/121		
Fought in past 4 weeks				
Yes	38	16/42	2.54	1.18, 5.50
No	19	23/118		
More likely than classmates to fight				
Yes	45	23/51	4.72	2.20, 10.15
No	15	16/106		
Start fights				
Yes	53	10/19	4.57	1.69, 12.36
No	20	27/138		
Believe having a weapon increases injury risk				
Yes	21	15/71	0.77	0.53, 1.12
No	28	24/87		

TABLE 6—Logistic Regression Model for Ever Having Carried a Knife for Protection or for Use in a Fight

Independent Variable	Males			Females		
	aOR	95% CI	*R*	aOR	95% CI	*R*
School B/eighth grade	1.45	0.42, 6.43	.000	3.24	0.85, 12.8	.076
No. victims known	1.05	0.98, 1.12	.027	1.19	1.05, 1.34	.178
Threatened/attacked with knife	5.74	2.11, 15.6	.223	2.20	0.46, 10.6	.000
Hitting Acceptable index	1.33	1.09, 1.62	.172	1.15	0.92, 1.44	.000
Shooting Acceptable index	0.86	0.70, 1.05	−.038	1.54	1.16, 2.04	.207
Image/Norms index	0.91	0.81, 1.01	−.078	1.15	0.98, 1.34	.076
More likely to fight and others start fights	5.67	1.97, 16.3	.206	3.10	0.80, 12.1	.063
Less likely to fight and starts fights	1.83	0.19, 18.2	.000	0.60	0.03, 11.0	.000
More likely to fight and starts fights	0.53	0.10, 2.80	.000	0.10	0.01, 1.85	.000
Ever been arrested	1.81	0.65, 5.04	.000	5.01	0.33, 75.7	.000
Disbelief that having a weapon increases injury risks	4.70	1.83, 12.1	.206	1.29	0.42, 3.91	.000
Goodness of fit	$G^*_y = 20.10$, $df = 11$, $p = .03$ $D = 140.36$, $\chi^2 = 129.26$, $df = 129$			$G^*_y = 14.70$, $df = 11$, $p = .19$ $D = 91.16$, $\chi^2 = 126.57$, $df = 115$		

Note. aOR = adjusted odds ratio; CI = confidence interval.

Our findings are not consistent with the image of otherwise law-abiding youths carrying guns solely for protection. Neither the belief that having weapons increased one's risk of being killed or injured by violence nor having been attacked or threatened with a weapon was significantly related to gun carrying after other factors in the model were controlled for. As was the case in other recent studies,[6,13,14] gun carrying could more realistically be explained as a part of an extremely aggressive, rather than defensive, system of thought and behavior.

Because respondents were not asked directly why they chose to carry a weapon, motivations for weapon carrying can only be inferred from the relationships between the hypothesized predictors and weapon carrying. The validity of self-reported motives for weapon carrying, however, is unknown and may well be poor.

TABLE 7—Logistic Regression Model for Ever Having Carried a Gun for Protection or for Use in a Fight, Seventh- and Eighth-Grade Males

Independent Variable	Odds Ratio	95% Confidence Interval	*R*
School B/eighth grade	1.46	0.19, 11.13	.000
No. victims known	1.13	1.04, 1.22	.194
Threatened/attacked with gun	3.60	0.92, 14.15	.095
Hitting Acceptable index	0.77	0.56, 1.03	−.086
Shooting Acceptable index	1.57	1.15, 2.16	.196
Image/Norms index	1.24	1.06, 1.45	.190
More likely to fight and others start fights	7.80	0.67, 90.67	.067
Less likely to fight and starts fights	2.60	0.11, 30.27	.000
More likely to fight and starts fights	51.50	4.46, 594.1	.228
Ever been arrested	16.05	3.78, 68.24	.281
Disbelief that having a weapon increases injury risk	1.95	0.46, 8.37	.000

Note. $\hat{C}_g$ = 4.96, *df* = 11, *P* = .94; *D* = 73.00, χ^2 = 89.36, *df* = 130.

Inferences based on empirical relationships between weapon carrying and suspected determinants may provide a better understanding of this key risk factor for violence.

This study is limited by its inclusion of only two junior high schools in high-crime neighborhoods in Washington, DC, and by its cross-sectional design. Additional studies are needed to determine how well these findings generalize to other youth populations. The findings also may not accurately characterize the determinants of weapon carrying among older adolescents. Although gun carrying among junior high school students appears to be primarily a function of criminal deviance and aggressive tendencies, less deviant and aggressive adolescents may later decide to start carrying guns purely for reasons of self-defense. The time sequence and causal relationships among weapon carrying and its correlates should be further delineated with longitudinal studies.

Greater insight into the determinants of weapon carrying could also come from studies that measure an array of attitudes about weapons. For example, under what circumstances do youths believe carrying a weapon is warranted? What do they think their peers think about weapon carrying, and how does this affect their decisions about whether or not to carry weapons? What fears or concerns do youths have about carrying weapons?

Provided that our findings are nominally generalizable, they may have important implications for the prevention of gun carrying among junior high school students. If gun carrying stems largely from antisocial attitudes and behaviors rather than from purely defensive motives of otherwise nonviolent youths, interventions designed to prevent delinquency may be more effective than those that focus only on educating youths about risks associated with carrying a gun. The latter may, however, be able to deter less hardened youths from carrying weapons in the future. Intensive and comprehensive interventions directed at high-risk children could possibly "inoculate" children against the many social factors that foster criminal deviance and the most violent behavior patterns.

Our study focused on individual-level determinants of weapon carrying, but the strongest determinants may be at the community or societal levels (e.g., availability of handguns, joblessness, lack of family supports, glamorization of violence). Inattention to social conditions that engender the desire, and the means, for youths to acquire guns will severely limit the effectiveness of interventions intended to change youths' attitudes and behaviors with respect to weapons. ☐

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Young Men's Risk Behaviors for HIV Infection and Sexually Transmitted Diseases, 1988 through 1991

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ABSTRACT

Objectives. This paper analyzes age- and period-related changes in risk behaviors for human immunodeficiency virus (HIV) infection and sexually transmitted diseases among young men in the United States between 1988 and 1991.

Methods. Data were from the 1988 and 1991 waves of the National Survey of Adolescent Males. The 1988 survey was a nationally representative survey of 1880 males aged 15 through 19 years. The 1991 survey was a longitudinal follow-up of 1676 males aged 17 through 22 years.

Results. As they aged, the young men increased their levels of sexual activity and decreased their condom use. Period-related changes between 1988 and 1991 were examined by comparing similar cohorts of 17.5- through 19-year-old men: there were signs that sexual activity and intravenous drug injection increased, but condom use did not change significantly. In 1991 51% of the young men said they were occasionally "high" during sex, a state that is related to reduced condom use.

Conclusions. Early progress in fostering safer behaviors among young men slowed and possibly stopped as the nation entered the 1990s. Prevention efforts need to be renewed and should focus on older youth and young adults. (*Am J Public Health.* 1993;83:1609–1615)

Introduction

The 1980s witnessed a rapid growth in public awareness about the risks of human immunodeficiency virus (HIV) and other sexually transmitted diseases. Accompanying the growth in awareness, numerous signs indicated that safer behaviors, especially behaviors relating to sexual activity and condom use, were being adopted.[1–3] Although there were initial doubts that teenagers, traditionally viewed as being resistant to prevention messages, would adopt safer behaviors, later surveys observed major changes in behaviors in response to the acquired immunodeficiency syndrome (AIDS) crisis. The level of condom use by teenaged males more than doubled between 1979 and 1988,[4] although condom use was often intermittent.[5] Teenaged females also reported substantial increases in condom use between 1982 and 1988.[6] This paper examines changes in risk behaviors for HIV infection and sexually transmitted diseases between 1988 and 1991, based on the National Survey of Adolescent Males. Behaviors examined include heterosexual and homosexual activity, condom use, and intravenous drug use.

The survey followed young men from adolescence, the period of initiation of sexual activity and other risk behaviors, into the beginnings of young adulthood, a time when sexual activity is often at its highest. The first wave of data collection occurred in 1988,[4] when publicity about AIDS may have been at its peak. The second wave of data collection occurred during late 1990 and early 1991,[7] when publicity about AIDS had decreased somewhat. For example, in June 1988, 86% of American adults recalled seeing a televised public service announcement about AIDS in the previous month[8]; this figure fell to 80% in 1991.[9] An automated search (conducted by the authors) of the *New York Times* found that the number of articles about AIDS rose between 1986 and 1988 but fell again by 1990. On the other hand, schools have offered more AIDS education in recent years, which is also salient for youth.[8–10]

Methods

The National Survey of Adolescent Males began in 1988 as a nationally representative survey of never-married, noninstitutionalized males aged 15 through 19 years living in households. The 1988 wave was conducted between April and December 1988. The original sample of 1880 males was drawn as a two-phase multistage area probability sample that oversampled Blacks and Hispanics. The original survey had a response rate of 74%. Initial sample weights were developed to account for probability of selection, nonresponse, and poststratification to match the March 1987 Current Population Survey.[11]

The second wave was conducted as a longitudinal follow-up survey about 2½ years after the initial interview, when the respondents were generally 17 through 22 years old. The follow-up survey was conducted between November 1990 and March 1991. (Hereafter, for convenience, we will simply call the second wave 1991, although about half of the data were col-

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TABLE 1—Descriptive Data on Heterosexual Sexual and Contraceptive Behaviors among Young Men, 1988 and 1991

	All Respondents			Similar Cohorts[a]		
	1988 Age 15–19 y	1991 Age 17–22 y	P	1988 Age 17.5–19 y	1991 Age 17.5–19 y	P
Ever had sex with a female, %[b]	60.4	83.6	<.001	75.0	78.6	NS
Mean age at first intercourse (among those sexually experienced), y[c]	14.9	15.6	<.001	15.4	15.2	<.05
Contraceptive use at last intercourse[b]						
Condom, %	56.2	44.2	<.001	53.0	55.9	NS
Female contraceptive method (without condom), %[d]	20.6	33.0		26.9	22.8	
No or other method, %	23.1	22.9		20.1	21.3	

Note: Ages are given in conventional chronological years (e.g., 15–19 includes up to 20th birthday). NS = not significant.

[a] In both periods, cohorts were never-married, noninstitutionalized 17.5- through 19-year-olds.

[b] Tested by chi-square.

[c] Tested by *t* tests.

[d] Female contraceptive methods include oral contraceptives, diaphragm, intrauterine device, contraceptive foam or jelly, and Today sponge. When combined with condom use, these methods are classified under condom use.

lected in late 1990.) Using a variety of tracking methods, we were fortunate to have an 89% follow-up rate and to retain 1676 respondents in the sample. (This number does not include 11 respondents who died between the two interview periods. Consistent with the national profile for young men's mortality, 4 died as a result of motor vehicle accidents, 4 were victims of homicide, and 3 committed suicide. One is reported to have committed suicide because he was HIV-positive.) Nonresponse analysis indicates that those who were lost to follow-up tended to be slightly older, although there were no significant differences by racial/ethnic group. More important, there was no significant attrition bias in any of the behavioral outcomes of interest). Longitudinal sample weights were developed that were based on the original weights, adjusted for loss to follow-up. In general, all analyses presented in this paper are weighted.

In both waves of the survey, the primary mode of data collection was face-to-face interviews, conducted in a confidential setting, between trained interviewers and the respondents. The most sensitive topics (e.g., substance use, risky sexual behaviors) were assessed with confidential self-administered questionnaires that the interviewer did not see. Recent methodological research compared self-administered questionnaires about drug use with face-to-face interviews and found that people were more likely to report sensitive behaviors in self-administered questionnaires.[12] In the follow-up, 32 interviews were conducted by telephone because it was not possible to conduct a personal interview. Some of those interviewed by telephone were in the military and had been mobilized for Operation Desert Shield/Desert Storm. It is important to remember that all data presented here are self-reported data of a sensitive nature and may be subject to intentional and unintentional reporting errors.

The number of acts of intercourse and consistency of condom use in the previous 12 months were constructed variables, based on partner-by-partner data for up to six partners in the previous year for 1988 and up to eight partners in the previous year for 1991. For relationships initiated earlier than 12 months before the interview, the proportion of acts of intercourse falling within the previous year was estimated based on the proportion of the relationship that had occurred within the 12-month window. For respondents with more than six partners in 1988 and those with more than eight partners in 1991, the number of acts of intercourse with the additional partners was imputed based on the levels for the partners with data available.

Results

Changes in Heterosexual Behaviors between 1988 and 1991

Public health efforts to stem HIV and other sexually transmitted infections focus on reducing levels of sexual activity (e.g., delaying initiation of sexual activity or reducing the number of partners) and increasing the use of condoms to protect against disease transmission. Previous analyses of the 1988 survey data found changes in sexual behavior and condom use compared with Zelnik and Kantner's 1979 National Survey of Young Men. For 17- through 19-year-old metropolitan males, the rate of condom use at last intercourse rose from 21% in 1979 to 58% in 1988. At the same time, however, there was a modest increase in the proportion of 17- through 19-year-olds who had had sexual intercourse: 66% were nonvirgins in 1979, vs 76% in 1988.[4] However, among sexually active teens, there were modest reductions in the number of partners and in the frequency of intercourse in the previous 4 weeks between 1979 and 1988.[13]

Table 1 compares a variety of standard measures of heterosexual activity and condom use between 1988 and 1991. In this table and in Tables 2 through 4, the columns headed "All Respondents" contrast the complete samples in 1988 and 1991. In a conventional longitudinal fashion, they indicate the status of the young men as they aged over the 2½ years of follow-up. The columns headed "Similar Cohorts" present data for subsamples who were similarly defined for each period: never-married, noninstitutionalized young men who were 17.5 through 19 years old. This strategy essentially examines the older half of the sample in 1988 and the younger half in 1991. The similar cohorts are almost completely independent. Only 12 of the sexually active men (1%) appear in both samples, owing to slight slippage in the 2½-year interval between interviews.

The proportion of all respondents who had had intercourse rose from about three fifths in 1988 (when they were 15 through 19 years old) to about five sixths in 1991 (when they were 17 through 22 years old). The proportion using condoms at last intercourse fell by about 12 percentage points, from 56% in 1988 to 44% in 1991. However, this decrease was offset by a switch to female contraceptive methods. Although there was an age-related decrease in use of condoms to protect against HIV or other sexually transmitted diseases, there was no net decline in protection against pregnancy.

Were these changes due to the fact that the respondents were 2½ years older at the time of the second interview, or to the fact that one survey was done in 1988 and the next in 1991? There were no significant changes in the proportion of respondents in the similar cohorts (17.5- through 19-year-olds) who had ever had sex, nor were there any significant changes in condom use. The shifts in sexual experience and contraceptive use seen in the overall sample appear to be primarily attributable to the fact that the respondents were 2½ years older in 1991.

Although the overall proportion of 17.5- through 19-year-olds who were sexually experienced did not change between 1988 and 1991, there was a small but significant decline in mean age at first intercourse, from 15.4 to 15.2 years ($P < .05$). There were other indications of changes in sexual activity, shown in Table 2. For both all respondents and the similar cohorts, there were significant increases in the mean number of partners in the previous 12 months and in the mean number of acts of intercourse in the previous 12 months and in the previous 4 weeks. The proportion of young men with five or more partners in the previous year also increased. Generally, sexually active young men reported beginning their sexual careers a little earlier, having more partners, and having somewhat more frequent intercourse in 1991 than in 1988. In both Tables 1 and 2, there is a small, nonsignificant trend toward increased condom use among the 17.5- through 19-year-olds. Regardless of statistical significance, the magnitudes of the differences are quite small.

Table 3 presents selected statistics by racial/ethnic group. Because samples sizes are smaller within racial groups, statistical power is reduced. For the overall sample, there were increases in the mean number of partners in the previous 12 months for all races, although the difference was not significant for White youths. That is, most young men tended to have more partners in a year as they aged into their late teens and early 20s. For the 17.5- through 19-year-olds, there were significant increases in the number of partners for Black youths, although the trends increased for White and Hispanic youths also. In the overall sample, the consistency of condom use fell by a mean of 8 to 10 percentage points for all racial/ethnic groups as they aged 2½ years. Condom use was more common among Black men in both 1988 and 1991.

TABLE 2—Heterosexual Sexual Activity and Condom Use among Young Men, 1988 and 1991

	All Respondents			Similar Cohorts[a]		
	1988 Age 15–19 y	1991 Age 17–22 y	*P*	1988 Age 17.5–19 y	1991 Age 17.5–19 y	*P*
Mean no. partners in last 12 mo (among those sexually experienced)[b]	2.1	2.5	<.01	2.0	2.6	<.05
Mean no. partners in last 4 wk (among those with 1 or more partners in last 12 mo)[b]	0.8	0.8	NS	0.8	0.8	NS
Mean no. acts of intercourse in last 12 mo (among those who had sex in last 12 mo)[b]	23.3	62.5	<.001	30.0	49.1	<.001
Mean no. acts of intercourse in last 4 wk (among those who had sex in last 4 wk)[b]	5.1	8.2	<.001	5.4	6.7	<.01
% with 5 or more female partners in last 12 mo[c]	4.4	10.4	<.001	6.3	10.7	<.01
Consistency of condom use (mean % of times used among those who had sex in last 12 mo)[b]	55.6	45.6	<.001	51.0	54.7	NS

Note. Ages are given in conventional chronological years (e.g., 15–19 includes up to 20th birthday). NS = not significant.

[a] In both periods, cohorts were never-married, noninstitutionalized 17.5- through 19-year-olds.

[b] Tested by *t* tests.

[c] Tested by chi-square.

TABLE 3—Selected Comparisons of Heterosexual Behavior and Condom Use among Young Men, 1988 and 1991, by Racial/Ethnic Group

	All Respondents			Similar Cohorts[a]		
	1988 Age 15–19 y	1991 Age 17–22 y	*P*	1988 Age 17.5–19 y	1991 Age 17.5–19 y	*P*
Ever had sex with a female, %						
Black	80.5	91.6	<.001	88.3	93.1	NS
White	56.7	82.6	<.001	72.8	76.2	NS
Hispanic	59.6	81.6	<.001	67.2	77.0	NS
Mean no. partners in last 12 mo (among those sexually experienced)[c]						
Black	2.6	3.6	<.01	2.4	4.3	<.01
White	2.0	2.3	NS	2.0	2.3	NS
Hispanic	1.7	2.1	<.01	1.8	2.1	NS
Consistency of condom use (mean % of times used among those who had sex in last 12 mo)[c]						
Black	61.4	50.3	<.001	57.2	58.1	NS
White	54.4	44.7	<.01	49.9	54.8	NS
Hispanic	51.1	42.6	<.01	42.6	48.3	NS

Note. Ages are given in conventional chronological years (e.g., 15–19 includes up to 20th birthday). NS = not significant.

[a] In both periods, cohorts were never-married, noninstitutionalized 17.5- through 19-year-olds.

[b] Tested by chi-square.

[c] Tested by *t* tests.

Changes in Higher-Risk Behaviors: Drug Injection and Homosexual Intercourse

The epidemiology of HIV and sexually transmitted disease infection indicates that certain behaviors are associated with a heightened risk of becoming infected or infecting one's partner.[2] These behaviors include using intravenous drugs, being the partner of an intravenous drug user, being the partner of a prostitute, and having homosexual intercourse, especially receptive anogenital intercourse. To maximize responses, all questions about these behaviors were asked by self-administered

TABLE 4—Frequencies of Behaviors Associated with Higher Risk of HIV and Sexually Transmitted Disease Transmission among Young Men, 1988 and 1991

	All Respondents, %			Similar Cohorts, %[a]		
	1988 Age 15–19 y	1991 Age 17–22 y	P[b]	1988 Age 17.5–19 y	1991 Age 17.5–19 y	P[b]
Ever had sex with a prostitute	0.7	2.5	<.001	1.0	1.6	NS
Ever had sex with an intravenous drug user	0.7	1.2	NS	1.4	0.9	NS
Ever used intravenous drugs	0.5	1.6	<.01	0.5	2.1	<.01
Ever had sexual contact (masturbation, oral or anal intercourse) with another male	2.1	1.4	NS	2.3	0.8	<.05
Ever had oral or anal intercourse with another male	1.5	1.0	NS	1.9	0.7	<.05
Ever had receptive anogenital intercourse with another male	0.9	0.5	NS	1.9	0.2	<.05

Note. In this table, the percentages use all respondents as the denominators. Ages are given in conventional chronological years (e.g., 15–19 includes up to 20th birthday). NS = not significant.

[a] In both periods, cohorts were never-married, noninstitutionalized 17.5- through 19-year-olds.

[b] Tested by chi-square.

questionnaires, but even so, most researchers would agree that these very sensitive items are probably underreported. As seen in Table 4, each of these behaviors was reported by fewer than 3% of the respondents in our sample. The very small sample sizes severely limit statistical power and indicate the problems in trying to survey relatively rare or stigmatized behaviors. With regard to these behaviors, researchers are concerned that bias may arise because disproportionate numbers of people at high risk may fail to participate in the survey or to answer specific questions.

For all respondents, there was a significant increase in the proportion of respondents who reported having sex with a prostitute or paying someone for sex, but this increase appears to be age-related because the 17.5- through 19-year-old groups were not significantly different. There were also significant increases in the percentage of respondents who reported using intravenous drugs, both for all respondents and for the 17.5- through 19-year-old similar cohorts. For the 17.5- through 19-year-olds, the percentage reporting intravenous drug use rose from 0.5% in 1988 to 2.1% in 1991. For both sex with prostitutes and intravenous drug use, the apparent increases might have been at least partly caused by small changes in question wording between 1988 and 1991. (The self-administered questionnaire asked in 1988, "Have you ever had sex with a prostitute?" In 1991, "Have you ever had sex with a prostitute or with someone you paid for sex?" In 1988, "Have you ever taken street drugs using a needle?" In 1991, "Have you ever taken street drugs, like heroin or cocaine, using a needle? This includes 'shooting up' and 'skin popping.'")

One of the most sensitive risk behaviors is homosexual activity. The percentage of young men who said they had ever engaged in sex with another man fell between 1988 and 1991, but we warn that the responses given were not reliable. For example, 30 respondents (unweighted) reported ever having oral or anal intercourse with another male in 1988, but in 1991 only 11 of these respondents acknowledged ever having oral or anal intercourse. Thirteen respondents who reported no oral or anal intercourse in 1988 said that they had engaged in these behaviors by 1991, although this change may reflect real changes in status. We checked and ruled out the possibility that this change was due to attrition of men with homosexual activity in 1991. It is plausible that some respondents were more open about their experiences in 1988 than they were 2½ years later. Although most survey researchers are aware of the difficulty of eliciting responses about extremely sensitive, stigmatized topics, this finding also raises questions about time-related reporting bias in retrospective data. These inconsistent findings prohibit us from drawing any firm conclusions about actual changes in the level of homosexual activity for young men between 1988 and 1991.

Risky Heterosexual Behaviors in 1991

In 1991 the survey included questions about drug and alcohol use related to sexual activity and about heterosexual anal intercourse. In addition to general public health concerns about substance use, there are specific concerns that if one or both members of a couple are high on drugs or alcohol during sex, they may be less responsible and less likely to use condoms or other contraception.[14] In earlier analyses of 1988 data, higher levels of cocaine or alcohol use were generally correlated with other risk behaviors, including having more partners, having intercourse more often, and using condoms less often.[5] The concern about anal intercourse is twofold. First, people may be less likely to use condoms during anal intercourse because the woman cannot get pregnant. Second, there may be a higher risk of transmission of HIV or other sexually transmitted diseases during unprotected anal intercourse because there may be greater physical trauma than during vaginal intercourse.

More than one quarter (26.3%) of sexually active young men said that they had been drinking before last having intercourse; 3.5% said that they had used drugs and 2.3% had used both drugs and alcohol. (The interviewer asked, "Before you had sexual intercourse the last time, had you been drinking wine, beer, or other alcoholic drinks?" "Before you had sexual intercourse the last time, had you been using marijuana, cocaine, or other drugs?") Asked about the extent to which they had been high on alcohol or drugs when having intercourse during the previous year, about half (49.3%) said that they never had been high and about 13% said that they had been high about half the time or more often. (The self-administered questionnaire asked, "During the last 12 months, how often were you 'high' on alcohol or drugs when you had sexual intercourse with a female?")

Black men reported using alcohol or drugs before sex less often than did White or other-race men. The comparisons between Black and Hispanic men are a little inconsistent: Black men reported using substances at last intercourse less often than did Hispanic men, but the distributions for being high over the previous year were quite similar for Black and Hispanic men. Substance use during sex generally increased with older ages.

As seen in Tables 5 and 6, substance use preceding sex was associated with reductions in condom use, both at last intercourse and over the previous 12 months. Measured over a 12-month period, substance use preceding sex was also associated with a larger number of partners and a greater frequency of intercourse. The relationships are not linear—that is, more substance use is not consistently related to more sexual activity—but the general trend is positive. This indicates that substance use poses double health threats. First, those who drink or use drugs prior to sex tend to have a greater volume of sexual activity, elevating the number of exposures to potential disease transmission. Second, the substance users are less likely to use condoms or female contraceptives, increasing the risk of any given act of intercourse.

About 9% of sexually active young males reported engaging in heterosexual anal intercourse in the previous 12 months (1 or 2 times, 4.0%; 3 to 10 times, 4.1%; more than 10 times, 0.8%). Unfortunately, 60% of those who engaged in anal intercourse never used condoms during anal intercourse and only 20% always used them. These rates of condom use are much lower than rates for vaginal intercourse. Although young people are aware of the need for protection during vaginal intercourse, they are probably less aware of its relevance during a riskier type of intercourse.

TABLE 5—Substance Use before Sex and Use of Contraceptives at Last Intercourse[a] among Sexually Experienced Males Aged 17 through 22 Years, 1991

	No Alcohol or Drug Use before Sex	Used Alcohol or Drugs before Sex	P
Condom, %	47.6	38.1	<.01
Female contraceptive method (no condom), %	32.4	33.9	
No or other method, %	19.9	28.0	

[a] Significance tested by chi-square.

TABLE 6—Substance Use before Sex and Behaviors over the Last 12 Months[a] among Sexually Experienced Males Aged 17 through 22 Years, 1991

	How Often "High" during Sex?					
	Never	Sometimes	About Half the Time	Often	Always	P
Consistency of condom use in last 12 mo (mean % of times used)	55.3	35.4	45.8	41.6	32.3	<.001
Mean no. partners in last 12 mo	1.9	2.7	4.1	4.5	3.5	
Mean no. acts of intercourse in last 12 mo	45.0	77.9	74.8	61.9	63.1	

[a] Significance tested by analysis of variance.

Discussion

Heterosexual Behaviors and Condom Use

As teenaged males move toward young adulthood their level of sexual activity increases (proportion nonvirgin, mean number of partners per year, mean frequency of intercourse) and condom use decreases. This pattern has been observed cross-sectionally[4,5,15] and is demonstrated longitudinally here. As males age, they tend to switch from reliance on condoms toward use of female contraceptive methods, especially oral contraceptives. Because they are more sexually active, the risk of HIV or sexually transmitted disease transmission becomes that much greater.

When we controlled for age differences through selection of similar cohorts, there were no significant changes in condom use or in the proportion of those sexually experienced between 1988 and 1991, but there were signs that 17.5- through 19-year-olds, particularly Black and other-race males, had more partners and more frequent intercourse in 1991 than in 1988. Why did the reported levels of sexual activity rise? Both methodological and substantive explanations are possible. On the methodological side, although we have defined the 17.5- through 19-year-olds to be as similar as possible, a key difference is that in 1991 the respondents were participating in the survey for a second time. The respondents may have been "conditioned" by having been interviewed in 1988. Respondents may have been more restrained in their responses to the first survey and less restrained in the second survey, leading to higher reports of sexual activity in the second survey. This could mean that reports in 1988 were understated or that reports in 1991 were overstated. We examined and ruled out the possibility that these findings were caused by attrition bias among those lost to follow-up; there were no significant differences in 1988 behaviors among those were followed up and those who were not.

The most likely explanation is that period-related increases in sexual activity did occur. This possibility is corroborated by the fact that the national rate of births to teenaged females rose between 1988 and 1990.[16] In contrast to our findings, the Centers for Disease Control's (CDC's) Youth Risk Behavior Survey, a nationally representative survey of high school students, found modest reductions in the proportion of students who had ever had intercourse and also found a reduced number of lifetime partners between 1989 and 1991.[10] The discrepancies may be due to the fact that the CDC high school sample was younger than our sample, to the fact that it pooled male and female students, or to the fact that it used a slightly different time frame.

Although there were large increases in condom use by adolescent males between 1979 and 1988,[4] there were essentially no increases between 1988 and 1991. The CDC also failed to find significant overall changes in the rate of condom use at last intercourse between 1990 and 1991.[10] There are also some signs that the sales of condoms slowed: market research data indicated that condom sales fell between 1990 and 1991[17]; other data showed declines in sales between 1991 and 1992.[18]

Higher-Risk Behaviors

/ The reported levels of intravenous drug use by males aged 17.5 through 19 years rose between 1988 and 1991. Changes in question wording make interpretation difficult. The National Household Survey on Drug Abuse indicates that drug injection among adolescents (aged 12 through 17 years) rose from 0.4% in 1988 to 1.6% in 1990, although there were no significant changes among people aged 18 through 25 years.[19,20] The CDC survey of high school students found no changes in level of reported drug injection between

1990 (1.5%) and 1991 (1.6%).[10] Although the percentage of adolescents using intravenous drugs is small, any apparent increase in drug injection is a cause for concern. Intravenous drug users are at greater risk not only for HIV infection but also for other serious health and social problems.

Our findings about homosexual behavior should not be interpreted as indicating a decline in the prevalence of homosexual activity. As discussed above, young men provided inconsistent responses to these questions. Although researchers can and should be willing to ask about sensitive behaviors, some methodological problems remain. The apparent reversal in responses among respondents who acknowledged homosexual intercourse in the first interview is troubling. Although we made strong efforts to be sensitive and to safeguard respondents' confidentiality, there was evidence that males were very reluctant to report engaging in sex with another man. Perhaps other methods, such as randomized response or item count techniques, are better suited to obtaining this information; however, it may be that men suppress this information so strongly that no interview process will obtain valid results. Further methodological research may help inform survey researchers about the best ways to study these important but highly stigmatized behaviors. The controversy about a recent report on adult male sexual behavior[21] indicates the level of interest in and methodological concerns about the measurement of these risk behaviors.

Conclusions

We examined a wide range of risk behaviors for HIV infection and sexually transmitted diseases among a nationally representative sample of young men in the United States from 1988 to 1991. Insofar as these behaviors are self-reported sensitive behaviors, there is potential for intentional and unintentional misreporting that may bias findings. On the other hand, many survey researchers believe that trend data are more reliable indicators, because biases present in one time period probably affect the other time period as well. Thus, even if an estimate for one time period is biased, trends between two time periods may be valid.

A great deal of policy and research attention has focused on teenagers. This study suggests that the transition from adolescence to adulthood is a period of even greater risk. As young men age, they tend to have more sexual activity, to use condoms less, and to engage in riskier sex (sex with prostitutes and substance use before sex). There has been a gratifying and potentially important increase in the prevalence of school-based AIDS education. From a public health perspective, we need to develop better means to reduce risk among older youths and young adults who are no longer in school, whether because they have dropped out or because of graduation. It is important to develop programs that can continue to provide educational messages and reinforcement in the community.

Previous studies have indicated that young Americans modified their behaviors during the late 1980s to reduce their risks of HIV or sexually transmitted disease transmission, including increasing condom use,[4] reducing the number of partners,[13] and reducing intravenous drug use.[22] The data reported here indicate that the trend toward safer behaviors has, at the very least, slowed. Indeed, there is evidence that the movement has stopped or even reversed. When similar cohorts of males aged 17.5 through 19 years were compared, there were signs that sexual activity (number of partners and frequency of intercourse) had increased between 1988 and 1991 and there were no significant increases in condom use. Although there were nonsignificant increases in condom use, they certainly do not compare in magnitude to the large increases witnessed earlier in the decade. It is of serious public health concern that there were signs, albeit imperfect, that intravenous drug injection rose among teenagers. Although intravenous drug use affects a very small proportion of youth, it is an extremely serious risk factor for HIV, as well as being a serious problem unto itself.

Why has the progress in behavioral change slowed and possibly even reversed? We posit two possible reasons. First, AIDS is no longer a new disease and therefore it has begun to shift in people's perception from being a dread disease toward being more commonplace.[23] Second, publicity about AIDS appears to have fallen off in the past few years. Although general publicity about AIDS has been declining, it appears that school-based AIDS education continues to grow.[10] Regardless of the cause, public health officials are faced with the challenge of renewing public interest in safer behaviors associated with AIDS and sexually transmitted diseases. Such an effort would not be futile, especially if it were directed at the youth who are most at risk. There was strong evidence that teenagers developed safer behaviors during the 1980s. Other research has indicated that AIDS education and sex education are associated with safer behaviors.[24,25] Over the years, public health policy has developed many tools to foster more responsible behaviors, but the effort needs reinvigoration. Although prevention messages should be directed at all groups, there is a special need to reach older youth and young adults. □

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Anthropometry and Childhood Mortality in Northwest and Southwest Uganda

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ABSTRACT

Two longitudinal studies were carried out in northwest and southwest Uganda to examine the relationship between anthropometry and childhood mortality. Although the prevalence of malnutrition was significantly different between the two geographic areas, the relative risk for mortality associated with low levels of anthropometry was similar. When the anthropometric parameters were compared among each other, mid-upper arm circumference was found to be the most powerful predictor of mortality. The findings of this study confirm that mid-upper arm circumference is the indicator of choice to identify children at higher risk of death. (*Am J Public Health.* 1993; 83:1616–1618)

Introduction

The strength of the relationship between malnutrition and mortality differs according to the country, the type of anthropometric parameter used, and the cutoff point selected.

Sommers and Lowenstein[1] showed a relative risk of 3.4 for children below the 10th percentile of arm circumference for height compared with those above the 50th percentile. Kielmann and McCord[2] found that among Indian children, mortality decreased exponentially with each 10% rise in median weight for age. In a study carried out in Bangladesh, Chen et al.[3] found a relative risk of around 3 among children who were below 60% in weight for age, with mid-upper arm circumference and weight for age being the most sensitive predictors of mortality. Briend et al.[4] confirmed in Bangladesh that mid-upper arm circumference had the highest sensitivity compared with weight for age, weight for height, and height for age.

However, other studies conducted in Guinea Bissau[5] and Zaire[6] showed a poor predictive power of anthropometry. Therefore, mortality associated with anthropometry varies between countries, and what has been found in Asia may not be applicable to Africa. This could be owing, in part, to the lower prevalence of wasting in Africa associated with a lower variability within the socioeconomic structure.[7]

This study sought to determine whether anthropometry can be used in an African country to identify children at higher risk of death.

Methods

In 1987 and 1988, 5498 children under 5 years of age were selected from 61 villages in two districts in northwest and southwest Uganda. The villages were selected with cluster sampling, with probability proportional to size. All the children residing in the villages were measured for weight, height (for children above 2 years of age), and length (for children below 2 years of age), and, in the southwest villages, for mid-upper arm circumference as well. A salter spring scale was used to measure weight within the nearest 100 g, and locally constructed boards were used to measure length and height to the nearest millimeter. Measurement techniques conformed to the United Nations manual, *How to Weigh and Measure Children.*[8]

Follow-up visits to all families 12 months later were used to assess mortality of the study children. The data were entered, cleaned, and analyzed using the Statistical Package for the Social Sciences (SPSS).[9] We transformed measurements into standard deviation scores of the median reference of the National Center for Health Statistics[10] using the Centers for Disease Control and Prevention package.[11]

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The views expressed in this article are the authors' and do not necessarily reflect those of the Uganda Ministry of Health, UNICEF, or CUAMM.

Results

Malnutrition was significantly higher in the northwest than in the southwest, but the mortality rates associated with low levels of anthropometry were similar in the two areas (Tables 1 and 2).

When levels of anthropometric parameters were compared, mid-upper arm circumference was associated with a relative risk for mortality that was significantly higher than that associated with other parameters (Tables 3 and 4). The relative risk for mortality associated with less than 11.5 cm of mid-upper arm circumference was more than 2 when compared with a standard deviation of less than −3 for weight for age, and less than −2 for weight for height and it was more than 4 when compared with a standard deviation of less than −3 for height for age. Low levels of weight for age and weight for height had almost the same relative risk, which was higher than that associated with low levels of height for age.

TABLE 1—Prevalence of Childhood Malnutrition and Mortality below Defined Anthropometric Cutoff Points, Northwest (NW) and Southwest (SW) Uganda

Cutoff	Geographic Area	Prevalence n	Prevalence %	Mortality below Cutoff n	Mortality below Cutoff %	Sensitivity	Specificity
< −3 SD W/A	NW	75/1066	7.0*	8/75	10.7	23	93
	SW	132/3768	3.5	12/132	9.1	12	97
< −3 SD H/A	NW	192/1066	18.0*	6/192	3.1	18	82
	SW	502/3768	13.3	23/502	4.6	24	87
< −2 SD W/H	NW	32/1066	3.0	4/32	12.5	12	97
	SW	142/3768	3.8	12/142	8.5	12	96
<11.5 cm MUAC	SW	96/3748	2.6	18/96	18.8	19	98

Note. SD = standard deviation; W/A = weight for age; H/A = height for age; W/H = weight for height; MUAC = mid-upper arm circumference.
*Prevalences between SW and NW are significantly different ($P < .0001$).

TABLE 2—Relative Risks (95% Confidence Intervals) for Childhood Mortality Associated with Different Anthropometric Cutoff Points in Northwest (NW) and Southwest (SW) Uganda

	Cutoffs in Standard Deviations (SD)		
	< −3 SD	−3 to −2 SD	> −2 SD
Weight for age			
NW	3.5** (1.6, 7.6)	0.8 (0.3, 2.3)	1
SW	4.7† (2.6, 8.6)	2.3*** (1.5, 3.7)	1
Height for age			
NW	0.7 (0.3, 1.8)	0.5 (0.2, 1.3)	1
SW	2.0** (1.3, 3.3)	1.1 (0.6, 1.8)	1
Weight for height			
NW	... ...	3.9* (1.4, 10.0)	1
SW	5.0** (1.9, 13)	3.2** (1.5, 6.4)	1
	Cutoffs for Mid-Upper Arm Circumference		
	<11.5 cm	11.5–12.4 cm	> 12.4 cm
SW	9.4† (5.9, 15.2)	2.6* (1.2, 5.5)	1

*$P < .05$; **$P < .01$; ***$P < .001$; †$P < .0001$.

TABLE 3—Comparison of Relative Risks for Mortality Associated with Different Parameters (95% Confidence Intervals) in Northwest Uganda

	Weight for Height < −2 Standard Deviation	Height for Age < −3 Standard Deviation
Weight for age: < −3 standard deviations	0.8 (0.3, 2.6)	3.4* (1.2, 9.5)
Weight for height: < −2 standard deviations	...	3.9* (1.5, 10.0)

*$P < .05$.

Discussion

Previous studies found that mid-upper arm circumference and weight for age were the most sensitive predictors of mortality in Asia[2-4]; however, these results were not confirmed in Guinea Bissau[5] and Zaire.[6] This suggests that anthropometry might play a relatively minor role in Africa in identifying children at higher risk of death. The data from this study confirm that, in Uganda, low levels of anthropometry are significantly related to mortality, with mid-upper arm circumference being the best predictor of mortality.

Although it is not possible to generalize the results outside the two areas surveyed, we can expect the results to be valid for this part of Africa. From a previous analysis not presented in this paper, the predictive power of mid-upper arm circumference for mortality was independent of age and was not improved by the addition of the other anthropometric parameters.[12] Besides being the most powerful predictor of mortality, mid-upper arm circumference does not need the knowledge of age below 5 years; it is cheap, quick, and easy to use; and it has fewer sources of error than other parameters. With a simple color-coded tape, mid-upper arm circumference could be used by those who are illiterate, with the advantage of identifying children at risk more effectively than other measuring methods.

Beyond these advantages, the effectiveness of mid-upper arm circumference is supported by the fact that, in the southwest, 45% of mortality was concentrated below 13.5 cm of mid-upper arm circumference. Considering that 17% of the examined children were below this measure and that 95% of the deaths below this cutoff point were due to infectious diseases, a reduction in mortality of 43% (95% of 45%) is theoretically possible if resources were prioritized on the 17% of the child population identified by mid-upper arm circumference as being at risk. In conclusion, this study confirms that the best indicator to identify children at risk is mid-upper arm circumference, which could be considered a simple and comprehensive proxy of deprivation to be used for target-

TABLE 4—Comparison of Relative Risks for Mortality Associated with Different Parameters (95% Confidence Intervals) in Southwest Uganda

	Weight for Age <−3 Standard	Weight for Height <−2 SD Standard	Height for Age <−3 Standard
Mid-upper arm circumference: <11.5 cm	2.1* (1.1, 4.1)	2.2* (1.1, 4.4)	4.1** (2.3, 7.3)
Weight for age: <−3 standard deviations	. . .	1.1 (0.5, 2.3)	2 (1, 3.9)
Weight for height: <−2 standard deviations	. . .	. . .	1.8 (0.9, 3.6)

*$P < .05$; **$P < .0001$.

ing, monitoring, and evaluating child survival programs. ☐

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The Authorship and Fate of International Health Papers Submitted to the *American Journal of Public Health* in 1989

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ABSTRACT

We reviewed the authorship characteristics, editorial processing, and final fate of 126 papers dealing with data from countries other than the United States and Canada and submitted to the *American Journal of Public Health* in 1989. The acceptance rate of these international health papers was 22%, similar to that of all papers (25%). Authors from developed countries had higher acceptance rates than authors from developing countries, but the highest acceptance rate (36%) was for international health papers with joint authorship from both developed and developing countries. Of 83 rejected papers, 72% were published in other journals. Of these, 45% were published in journals covered by *Index Medicus,* a figure similar to that for all papers rejected by the Journal. (*Am J Public Health.* 1993;83:1618–1620)

Introduction

The *American Journal of Public Health,* the official journal of the American Public Health Association, is widely read throughout the world. Therefore it is understandable that health professionals from other countries submit papers to the Journal in the hope of reaching its broad readership.

In recent years, however, the Journal has noted an increase in the number and proportion of papers received from countries other than the United States and Canada, as well as an increase in the acceptance rate of such papers (Table 1). Stossel and Stossel observed a similar phenomenon in papers published by four prestigious English language journals from 1977 to 1988.[1] We decided to explore this situation in greater depth by describing the authorship, processing, evaluation, and eventual outcome of all international papers received by the Journal in 1989.

Methods

In Table 1, only papers received from countries outside the United States and Canada are defined as international health papers. We have also examined accept-

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TABLE 1—Papers Received by the *American Journal of Public Health* and Acceptance Rates, 1983 through 1989

Year	Total No. Papers Received	International Health Papers No.	International Health Papers %	Acceptance Rates, % US/Canada	Acceptance Rates, % International
1983	778	41	5	22	10
1984	830	53	6	23	11
1985	782	59	7	27	10
1986	932	55	6	22	15
1987	957	77	8	26	13
1988	1038	104	10	24	13
1989	1043	111	11	25	22

Note. International papers are defined as papers received from countries other than the United States and Canada.

TABLE 2—Number and Acceptance Rate of International Health Papers Submitted to the *American Journal of Public Health* in 1989 (n = 126), by Nationality of First Author

Nationality of First Author	No. Papers Submitted	Acceptance Rate, %
United States and Canada[a]	32	28
Western Europe	35	31
Eastern Europe	1	0
Japan	3	0
Australia	10	30
South Africa	4	0
China, Taiwan, Hong Kong	6	0
Israel	9	22
Developing countries	26	12

[a] Papers dealt with data from other countries.

ance rates when international health papers are defined as papers from investigators based in US and Canadian institutions whose research dealt with data from other countries. We recorded authors' names, institutional affiliations, and data sources; the comments of reviewers and the Editor; and the Editor's decision; if rejected, we recorded the reason for rejection.

Eighteen to 30 months later, a letter from the Chair of the International Health Section of the American Public Health Association queried the first authors of all rejected papers by mail to determine whether their papers had been sent to another journal before being submitted to the *American Journal of Public Health,* whether the papers were sent to another journal after rejection, and the outcome of the latter submission. Nonrespondents were contacted by telephone.

Results

Of the 1043 manuscripts submitted to the Journal in 1989, complete information was available on 1013, 126 of which were international health papers as defined by us. The acceptance rate of these 126 papers was 22%, essentially the same as that of papers dealing with data from the United States or Canada (25%). Thirty-one of the international papers were rejected by the Editor without external review. A similar proportion of all papers received by the Journal in 1989 were rejected without external review (A.Y.).

The first author of all international health papers was more often the citizen of a developed country, and the acceptance rate of such papers was substantially higher than that of papers whose first author came from a developing country (Table 2). Sixteen papers, all of whose authors were American or Canadian, had acceptance rates of 25%, compared with an acceptance rate of 17% for 82 papers authored by only foreign authors. However, the 28 papers with authors from both foreign and US/Canadian institutions fared best of all with an acceptance rate of 36%.

The Editor followed the advice of both reviewers for 25 of the 28 accepted papers; for 3 accepted papers he agreed with one reviewer, whereas the other reviewer recommended rejection. For 62 rejected papers that were reviewed externally, the editor agreed with both reviewers in 32 cases, the reviewers disagreed between themselves in 20 cases, and in 10 cases both reviewers recommended acceptance of papers that the Editor rejected. These proportions are similar to those found in an in-house study by one of us (A.Y.). The authors of four papers were asked to revise but failed to respond to repeated queries. One paper turned out to have been published previously and was therefore rejected.

The reasons for rejection of 93 papers were as follows: 16 provided no new information, 40 were technically flawed, 21 were deemed to be of only local interest, and 16 were considered more appropriate for clinical or specialty journals.

Eighty-three of the first authors of the 98 rejected papers answered the follow-up query. Twelve had tried to publish their papers in journals listed in the *Index Medicus* prior to submission to the Journal. After rejection by the Journal, 63 (76%) resubmitted their paper to other journals and 60 (72%) were accepted, 37 (45%) by a journal covered by *Index Medicus.*

Discussion

Although many international health papers require more than the usual editorial attention, there was no bias against them in the editorial process. Their acceptance rate was similar to that of all papers. The proportion rejected without review and the proportion rejected against the advice of one or more reviewers were also similar to those of all papers. The high acceptance rate of rejected papers by other journals is only slightly less than that reported for the *Journal of Clinical Investigation*[2] and the *New England Journal of Medicine* in 1978.[3] The proportion published in journals covered by *Index Medicus* is similar to that of all papers rejected by the *American Journal of Public Health.*[4]

The fact that only a fifth of the first authors of international health papers were from developing countries can be explained by the dearth of research in these countries.[5] Many health professionals from developing countries who are well trained in Europe, Canada, or the United States have difficulty finding suitable jobs in their countries of origin.[6] In some instances they have even encountered hostility and opposition by rigid local hierarchies when they return.[7] The acceptance rate of papers all of whose authors were from developing countries was low. Many such papers dealt with routine local service statistics or failed to contribute to the field of international health.

On the other hand, epidemiologic and health service research from developing countries is often relevant to North American professionals. A new journal of international public health has been suggested to accommodate such papers. However, we believe establishment of such a journal could deprive *American Journal of Public*

Health readers of information relevant to their own interests and that the concept of thematic issues of the Journal is a better way of increasing the number and improving the quality of international health papers.

Several successful programs are trying to promote the development of health service and epidemiologic research in the developing world. Among them are the Independent International Commission on Health Research for Development,[8] the International Clinical Epidemiology Network,[9] the Rockefeller Foundation's Greatly Neglected Diseases Network,[10] and several World Health Organization initiatives, such as the Tropical Diseases Research Program. All of these programs aim at international cooperation in research. The fruits of such international collaboration are reflected in the Journal's high acceptance rate of papers whose authors were from both developing and industrialized countries. ☐

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Screening for Colorectal Neoplasia: Physicians' Adherence to Complete Diagnostic Evaluation

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ABSTRACT

This prospective study was done in a health maintenance organization colorectal cancer screening program to determine whether 166 persons found to have abnormal fecal occult blood test results typically underwent complete diagnostic evaluation (i.e., either colonoscopy or barium enema x-ray plus flexible sigmoidoscopy). Chart audit data show that 137 (82%) subjects contacted a physician to discuss follow-up. A complete diagnostic evaluation was recommended to only 52 (38%) patients who talked with a physician. Forty-two (81%) patients who were advised to get a complete diagnostic evaluation actually complied. Significant differences in clinical findings were observed for patients who did and did not have a complete diagnostic evaluation. (*Am J Public Health.* 1993;83:1620-1622)

Introduction

During their lifetimes, American men and women have about a 5% chance of developing large-bowel cancer.[1,2] Recent figures indicate that in 1992, there were over 156 000 new colorectal cancer cases and more than 58 300 deaths from colorectal cancer.[3]

Screening programs for colorectal cancer usually employ fecal occult blood tests to detect early-stage cancer. This screening test is recommended by the American Cancer Society and the National Cancer Institute for annual use by men and women 50 or more years of age. Controlled trials are being carried out in the United States and Europe to determine whether mortality can be reduced by screening for fecal occult blood.[4-8]

It is recommended that persons with abnormal fecal occult blood test results undergo complete diagnostic evaluation (i.e., either colonoscopy or barium enema x-ray plus flexible sigmoidoscopy).[9,10] The study described here is a prospective assessment of adherence to complete diagnostic evaluation guidelines in colorectal cancer screening.

Methods

In spring 1989, a cohort of men and women (n = 2201) 50 or more years of age was randomly selected from 12 800 individuals who had joined HMO PA/NJ within the previous year. HMO PA/NJ is a prepaid health care plan of US Healthcare Inc, an independent practice association-type health maintenance organization (HMO). On joining the HMO, each subject had selected an affiliated primary-physician office as his or her medical care provider. Study subjects were mailed a

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free screening kit, which included three HemaWipe fecal occult blood tests, through an HMO colorectal cancer prevention program known as US HEALTHCARE CHECK. Persons who did not return tests within 15 days were mailed a reminder letter. Subjects whose test results were positive (n = 166) were notified by mail, as were the offices of their primary physician (*n* = 121). The subject notification letter encouraged recipients to discuss follow-up with their primary physician. A medical chart audit was done 6 months later to collect data on diagnostic evaluation and diagnosis.

Results

The chart audit revealed that 137 (83%) subjects had contacted a primary physician to discuss follow-up. This figure was significantly lower ($P = .0006$) than our projected rate of contact (i.e., 90%).[11] For 18 (11%) subjects, there was no record in the chart of any contact in which follow-up of the abnormal test result was discussed. In 11 (7%) cases, no patient chart could be located. This situation indicates that the patient had never visited the office.

For the 137 patients who had contacted a physician, it was found that only 52 (38%) were advised to have a complete diagnostic evaluation; 75 (55%) were advised to have diagnostic procedure(s) other than a complete evaluation. Recommended procedures other than a complete diagnostic evaluation included a repeat fecal occult blood test (n = 34), digital rectal examination (n = 18), barium enema x-ray (n = 14), complete blood count (n = 14), flexible sigmoidoscopy (n = 8), upper gastrointestinal x-ray (n = 7), rigid sigmoidoscopy (n = 3), and other unspecified procedures (n = 2). The number of procedures totals more than 75 because some patients were advised to have more than one procedure. Finally, it was determined that 10 (7%) patients were advised to have no further workup. It was also discovered that of the 52 individuals who were advised to have a complete diagnostic evaluation, 42 (81%) actually underwent the procedure(s).

Differences in findings for subjects who did and did not undergo complete evaluation were marked ($P < .0001$).[12] Specifically, diagnoses of patients for whom it was verified that a complete diagnostic evaluation was done (n = 42) included 1 cancer case, 10 polyp cases, 21 "other" cases (i.e., hemorrhoids, diverticulitis, stomach ulcer), and 10 cases with normal findings. Diagnoses recorded for patients who underwent procedures other than complete evaluation (n = 75) were 3 polyp cases, 25 "other" cases (i.e., hemorrhoids, diverticulitis, stomach ulcer), and 57 cases with normal findings. No diagnosis was available for 20 subjects.

Discussion

Complete diagnostic evaluation is routinely done for persons with a positive fecal occult blood test result in randomized controlled trials. When colorectal cancer screening is done at the community level, however, complete evaluation of abnormal test results is often not done.[13–15] We have discovered that most patients with an abnormal fecal occult blood test contact a physician to discuss follow-up care; however, many do not actually undergo a complete diagnostic evaluation. Our findings are consistent with a recent report that suggested that 37% to 63% of patients who present at a physician's office with an abnormal fecal occult blood test result undergo a complete diagnostic evaluation.[16] For individual patients, incomplete diagnostic evaluation may result in delay or failure to detect colorectal cancer and polyps. At the population level, a low rate of complete diagnostic evaluation in a screening program is likely to minimize any potential contribution of screening to the reduction of morbidity and mortality. It should be noted that the problem of incomplete diagnostic evaluation has also been reported in screening for other types of cancer.[17–19]

By observing physician–patient contact in follow-up care, we also found that most persons with a positive fecal occult blood test result had consulted with a physician; however, in most cases, it appears that they were not advised to have a complete diagnostic evaluation. The practice of recommending follow-up procedures other than complete diagnostic evaluation may reflect physicians' uncertainty about preventive care in general[20–22] or about colorectal cancer screening in particular.[23] It may be hypothesized that factors that could give rise to physicians' uncertainty about recommending complete diagnostic evaluation include physician confidence in screening, knowledge about the procedures that constitute complete evaluation, past experience in following up positive fecal occult blood test results, concern about cost and safety issues, and perceived patient preferences.[24–26] Unfortunately, data were not collected in this study to determine which, if any, of these factors were associated with physicians' reluctance to recommend complete evaluation. Further research is required to understand why physicians eschew recommending complete evaluation. Studies are also needed to determine how to increase the use of complete evaluation. In this regard, HMO PA/NJ has introduced a continuing medical education program for physicians to enhance the quality of care delivered to screening program participants.

The extent to which the observations reported here can be generalized may be limited by characteristics of the HMO, the affiliated physicians and subscribing members, and the screening program. It also should be acknowledged that chart audit data are limited in accurately reflecting physicians' recommendations to patients. ☐

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The Epidemiology of Child Abuse: Findings from the Second National Incidence and Prevalence Study of Child Abuse and Neglect

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ABSTRACT

The epidemiology of child abuse was investigated with data from the Second National Incidence and Prevalence Study of Child Abuse and Neglect. A statistical comparison of incidence rates suggested that age, family income, and ethnicity were risk factors for both sexual abuse and physical abuse, but county metrostatus was not. Gender was a risk factor for sexual abuse but not for physical abuse. A logistic regression analysis showed that ethnicity, county metrostatus, and a gender-by-income interaction distinguished sexual abuse from physical abuse. (*Am J Public Health.* 1993;83:1622–1624)

Introduction

The Second National Incidence and Prevalence Study of Child Abuse and Neglect was mandated by Congress in 1984 (1) to assess the current national incidence and prevalence of child abuse and neglect and (2) to determine how the severity, frequency, and character of child maltreatment had changed since 1980 when the First National Incidence Study was conducted.[1–3] A more extensive analysis of these large-scale, nationally representative studies could provide valuable scientific knowledge on the scope and nature of child maltreatment and its impact on public health issues.[4–7]

Using data from the Second National Incidence Study, we sought to examine the impact of five key demographic factors—age at discovery, gender, income, ethnicity, and county metrostatus—on sexual abuse and physical abuse. In addition, using these variables, we compared the risk of sexual abuse with the risk of physical abuse. The latter analysis is similar to one previously conducted by Jones and McCurdy.[5] However, these investigators used unweighted data, whereas we used the appropriate sampling weights, which gave the correct estimates of the standard errors associated with the regression coefficients and hence were more reliable for hypothesis tests and confidence interval estimations. Emotional abuse has been excluded from our analyses because it was more difficult to define and measure.[8,9]

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Methods

Study Design

Data for this study were collected between September 7 and December 6, 1986. A weighted multistage cluster probability sample was used.[2,3] A nationally representative sample of counties consisting of 28 county-level primary sampling units located in 19 states was selected. Cases were identified through Child Protective Services, as well as through other community professional agencies (e.g., hospitals, schools, day-care centers, social services, and municipal police).

Definitions

"Incidence rate" is defined as the number of new cases of maltreated children *reported* in 1986. Reported cases contain both official reports of abuse known to Child Protective Services and unofficial reports of abuse known to professionals and investigatory agencies other than Child Protective Services. The definition of sexual abuse included intrusion, molestation with genital contact, and other or unknown sexual abuse that was perpetrated or permitted by an adult caretaker, parent, or parent substitute. Unlike sexual abuse, physical abuse was not broken down into more specific forms of maltreatment, but was said to occur when a child suffered a physical injury as a result of actions by a parent or caretaker.

Statistical Analysis

First, we statistically evaluated each of the five potential risk factors for sexual abuse and physical abuse by comparing two given categories (subgroups) of a potential risk factor. Then, we quantified the odds of a child's being sexually abused relative to the odds of a child's being physically abused as a function of the five risk factors by performing a multivariate logistic regression analysis. The weighted results were generated by the WESVAR program[10] for the descriptive results and the WESLOG program[11] for the logistic regression results. All statistical tests were based on two-tailed tests at the .05 level of significance.

Results

Descriptive Analysis

The results showed that an estimated total of 133 619 children were reported as being sexually abused in 1986, which represents an estimated incidence rate of 2.11 per 1000 children. An estimated total of 311 524 children were reported as being physically abused in 1986, which represents an estimated incidence rate of 4.95 per 1000.

TABLE 1—Potential Demographic Risk Factors for Sexual Abuse and Physical Abuse

	Sexual Abuse				Physical Abuse			
	Rate (per 1000)	Standard Error	95% CI		Rate (per 1000)	Standard Error	95% CI	
Risk Factor			Lower	Upper			Lower	Upper
Age, y								
0–2	0.36	0.09	0.17	0.54	2.43	0.48	1.43	3.44
3–5	2.41	0.59	1.20	3.63	4.17	0.77	2.68	5.65
6–8	2.07	0.53	0.98	3.17	4.91	0.80	3.25	6.57
9–11	2.46	0.64	1.12	3.79	5.18	1.09	2.92	7.44
12–14	2.58	0.36	1.83	3.33	6.61	1.25	4.01	9.21
15–17	2.87	1.23	0.31	5.42	6.33	1.30	3.62	9.04
Sex								
Girls	3.28	0.43	2.39	4.17	5.55	0.77	3.96	7.13
Boys	1.00	0.31	0.37	1.62	4.33	0.35	3.62	5.04
Difference								
Girls–boys	2.28*	0.48	1.29	3.28	1.22	0.78	−0.39	2.81
Income								
<$15 000	4.49	0.92	2.60	6.39	8.73	0.90	6.87	10.60
≥$15 000	0.81	0.14	0.51	1.10	2.13	0.42	1.25	3.00
Difference								
Less–more	3.68*	0.89	1.86	5.51	6.61*	0.81	4.92	8.28
Ethnicity[a]								
White	1.99	0.28	1.42	2.56	4.32	0.48	3.36	5.31
Black	2.02	0.53	0.92	3.12	7.68	1.44	4.71	10.66
Other	0.87	0.52	−0.21[b]	1.94	3.24	1.24	0.69	5.79
Difference								
Black–White	0.03	0.51	−1.02	1.07	3.36*	1.55	0.16	6.57
Black–other	1.15	0.75	−0.40	2.70	4.44*	1.84	0.65	8.22
White–other	1.12*	0.48	0.13	2.12	1.08	1.41	−1.83	3.99
County metrostatus[c]								
Major urban	1.88	0.76	0.30	3.45	4.97	1.60	1.67	8.27
Urban	2.40	0.71	0.93	3.86	5.10	1.36	2.29	7.90
Rural	1.96	0.81	0.29	3.62	4.63	1.90	0.70	8.33
Difference								
Major urban–urban	0.52	1.23	−3.06	2.02	−0.13	2.54	−5.36	5.11
Major urban–rural	−0.08	1.12	−2.39	2.23	0.34	2.62	−5.07	5.75
Urban–rural	0.44	1.29	−2.21	3.09	0.47	2.87	−5.94	6.38

Note. CI = confidence interval.

[a] The White category included Whites and Hispanics, the Black category included Blacks not of Hispanic origin, and the other category included all other ethnic groups (including American Indian, Alaskan Native, Asian, Pacific Islander).

[b] Practically speaking, this number can be increased to zero, because a negative incidence rate is not possible.

[c] Major urban counties included the 32 largest metropolitan areas in the country, urban counties included the other metropolitan areas, and rural counties included the remaining areas.

*$P \le .05$.

Table 1 shows that, for both types of abuse, the five oldest age groups had a substantially higher rate of physical abuse than the birth-to-2-year-olds, although the older age groups did not differ statistically among themselves. Girls had a higher rate of sexual abuse than boys; physical abuse did not appear to vary by the child's gender. Family income was a significant risk factor for both physical abuse and sexual abuse. Whites were more likely to be identified as sexually abused than non-Black minorities. Black children were physically abused at a significantly higher rate than White children and children in "other" ethnic groups. Finally, there were no urban–rural differences in the rates of sexual abuse or physical abuse.

Logistic Regression Results

Table 2 shows the logistic regression results predicting the odds of sexual abuse relative to physical abuse. Compared with physical abuse, sexual abuse was more likely (1) for Whites than Blacks, (2) for girls than boys regardless of family income, and (3) for children residing in urban areas than for children

TABLE 2—Odds Ratio Estimates and 95% Confidence Intervals for Predicting the Likelihood of Sexual Abuse Relative to Physical Abuse

Risk Factor	Odds Ratio Estimates (Sexual Abuse Relative to Physical Abuse)	95% Confidence Interval of True Odds Ratio
Race (Black to White)	0.33*	0.25, 0.44
Sex (girls to boys)	3.74*	2.67, 5.24
Sex × income	0.44*	0.31, 0.63
Major urban to rural	1.37*	1.01, 1.86
Urban to rural	1.35*	1.01, 1.82
Family income (<$15 000 to ≥$15 000)	1.15	0.95, 1.38
Race (non-Black minorities to White)	0.81	0.47, 1.37
Age (birth–12 years old to 13–18 years old)	0.95	0.82, 1.10

Note. Fewer than 2% of the cases involved both sexual abuse and physical abuse. These cases were classified as sexually abused in the reported analysis.

*$P \leq .05$.

residing in rural areas. In addition, the somewhat higher risk of sexual abuse relative to physical abuse for girls varied by income, with a greater gender difference in risk for lower income families.

Discussion

In this paper we present data from the Second National Incidence and Prevalence Study of Child Abuse and Neglect regarding rates of physical and sexual abuse. We found that the rates of physical and sexual abuse varied as a function of the sociodemographic characteristics of the child and his or her family and that these characteristics helped distinguish between those children at risk for physical abuse and those at risk for sexual abuse. Some of our findings, such as the fact that low income was a significant risk factor for both forms of maltreatment, serve to confirm data reported in other studies. Other findings, such as the differential effect of gender as a function of income when the risk of sexual vs physical abuse is predicted, have not previously been reported.[8,12,13] Unlike the results of Jones and McCurdy,[5] our logistic regression findings showed that, relative to physical abuse, sexual abuse was more likely for Whites than for Blacks but not more likely for Whites than for other racial groups.

Although the data from the Second National Incidence Study have several major limitations (see Finkelhor and Hotaling for a critique[14]), they are the best available data from which to derive national estimates for the incidence of child abuse and neglect. These data also have value for advancing basic knowledge about child maltreatment and for informing public policy, particularly with regard to estimating the extent of the problem of child maltreatment beyond what is reported to official sources. The data may also help to dispel certain widely held assumptions about maltreatment, such as the assumption that younger children are at greater risk for abuse than older children. More extensive analyses of the data from both the Second and the First National Incidence Studies not only would help refine our current understanding of child maltreatment, but also would highlight aspects of study design that need improvement for future incidence studies. ☐

Acknowledgments

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Activity, Inactivity, and Obesity: Racial, Ethnic, and Age Differences among Schoolgirls

Anne M. Wolf, MS, RD, Steven L. Gortmaker, PhD, Lilian Cheung, DSc, RD, Heather M. Gray, AB, David B. Herzog, MD, and Graham A. Colditz, MBBS, DrPH

ABSTRACT

Physical activity, inactivity, and obesity were assessed by questionnaire among a multiethnic sample of 552 girls in grades 5 through 12. Hispanics and Asians reported lower activity levels than other racial groups. Only 36% of the entire sample and less than one fifth of either Asians or Hispanics met the year 2000 goal for strenuous physical activity. Physical activity was inversely associated with age and age-adjusted body mass index. Obesity was unrelated to inactivity. (*Am J Public Health.* 1993; 83:1625–1627)

Introduction

Although studies have explored the frequency[1] and determinants[2] of children's participation in physical activities, racial/ethnic and age differences (elementary to high school) in activity levels have not been studied; also, the relationship between physical activity, sedentary behavior, and the prevalence of obesity in different racial/ethnic and age groups has not been examined. This study explored race-, ethnicity-, and age-related differences in activity, inactivity, and obesity among a multiracial sample of girls in grades 5 through 12 living in a low-to-medium income northeastern town.

Methods

A school-based survey was administered from February through May 1991 to 552 girls residing in Lynn, Mass. The ethnic composition of the study population (64.3% White, 15.4% Black, 11.2% Hispanic, 4.3% Asian, and 4.7% other/mixed) was representative of the school district. Elementary schools (grades 5 and 6), junior high schools (grades 7 and 8), and high schools (grades 9 through 12) contributed 29.5%, 37.1%, and 33.3%, respectively, of the study population. After active parental consent was obtained and dropouts and absentees were excluded, the estimated response rate among students who were eligible to receive the questionnaire was 78%.

Physical activity was self-reported on the Godin-Shepard Physical Activity Survey,[3] which has good 2-week test–retest reliability and construct validity among children.[4] The survey was modified by developing closed-ended options for frequency of participation (range: less than one to more than five times per week). A total exercise score was derived as follows:

$$\text{Total Exercise} = (\text{Frequency of Mild Exercise} \times 3) + (\text{Frequency of Moderate Exercise} \times 5) + (\text{Frequency of Strenuous Exercise} \times 9)$$

Height and weight were self-reported. Obesity was defined by age- and sex-appropriate reference data of body mass index (kg/m^2) at the 85th percentile.[5] Sedentary behavior or inactivity was assessed by number of hours of television viewed per day; six closed-ended categories (ranging from less than 1 hour to 9.5 hours per day) were used in these assessments.

Statistical Analysis Software[6] was used in conducting statistical analyses. Age, race, and age-adjusted body mass index were controlled for in these analyses. Indicator variables were used for racial/ethnic and age groups, with White and high school as the referent groups.

Results

The distribution of participants by age, body mass index, physical activity, and television use is shown for each racial/ethnic and age group in Table 1.

Physical Activity

Physical activity varied by ethnicity. Table 2 shows ethnic differences in physical activity adjusted for age. The other/mixed group reported the most activity; the largest proportion of the scores of this group were the result of strenuous exercise. After controlling for age, Asians and Hispanics reported 8.81 ($P < .01$) and 12.61 ($P < .0001$) fewer activity units, respectively, than did the referent group; a large proportion of the activity for both ethnicities involved mild exercise. Only 36.4% of the entire sample and less than

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TABLE 1—Percentage Distribution of Age, Body Mass Index, Physical Activity, and Television Use by Race/Ethnicity: 551[a] Girls in Grades 5–12

	White (n = 355)	Black (n = 85)	Hispanic (n = 60)	Asian (n = 24)	Other (n = 27)	Total (n = 551)
Age, y						
≤11	28.2	14.1	21.7	20.8	18.5	24.5
11–14	48.7	48.2	50.0	54.2	51.8	49.3
>14	23.1	37.6	28.3	25.0	29.6	26.3
Body mass index, percentile						
≤15th	9.0	10.6	11.7	12.5	11.1	9.8
>15th–85th	69.0	51.8	61.7	83.3	66.7	65.9
≥85th	22.0	37.6	26.7	4.2	22.2	24.3
Strenuous physical activity, h/wk						
≤1	27.6	40.0	46.7	37.5	22.2	31.7
1–3	57.2	49.4	51.7	62.5	48.2	55.2
>3	15.2	10.6	1.7	0.0	29.6	13.0
Minimum strenuous activity (15-min duration >3 times/wk)[b]	40.7	31.0	20.3	16.7	51.9	36.4
Television use, h/d						
≤2	25.9	11.8	26.7	25.0	11.1	23.0
>2–5	53.8	38.8	50.0	45.8	40.7	50.2
>5	20.3	49.4	23.3	29.2	48.2	26.8

Note. Body mass index and percentile categories were based on age- and sex-specific general population data from National Health and Nutrition Examination Survey I.[5]

[a] Classification of race/ethnicity was missing for one girl.

[b] Year 2000 objective for the nation for strenuous physical activity.

TABLE 2—Obesity and Self-Reported Physical Activity by Ethnicity and School Level: 551 Girls in Grades 5–12

	n	Obese,[a] %	Adjusted Total Exercise Score (SE)	Distribution of Exercise Level from Total (Unadjusted) Score, %		
				Mild	Moderate	Strenuous
Ethnicity/race						
Asian	24	4.2	33.79 (5.0)	38.7	23.1	38.2
Black	85	37.6	39.06 (3.3)	30.0	25.2	44.9
Hispanic	60	26.7	30.0 (3.6)	32.5	25.4	42.5
White	355	22.0	42.6 (1.1)	26.7	24.9	48.2
Other/mixed	27	22.2	47.17 (4.7)	22.0	21.2	56.8
Grade level						
Elementary school	164	29.3	47.21 (3.8)	21.7	25.6	52.5
Junior high school	205	20.5	41.57 (3.7)	29.9	23.8	46.4
High school	183	24.5	39.29 (1.8)[b]	31.9	24.8	43.2

Note. The relationship between race/ethnicity and total exercise score was adjusted for age via multiple regression; the relationship between age and total exercise score was adjusted for race/ethnicity via multiple regression. Classification of race/ethnicity was missing for one girl.

[a] Defined as a body mass index equal to or greater than the 85th percentile for age in the general population using data from National Health and Nutrition Examination Survey I.[5]

[b] The referent was White high school student.

50% of most ethnic groups met the year 2000 objective for the nation for strenuous physical activity (Table 2).

Physical activity also varied by age (Table 2). The total activity level was 24% higher for elementary than for high school students. Total activity and strenuous activity decreased, and mild exercise increased, with age (Table 2). There was no interaction between age and race in their association with total exercise.

Inactivity

There were no grade-level differences in hours of television watched; however, racial/ethnic differences were observed (Table 1). Television viewing was not correlated with physical activity after adjusting for age (partial $r = -.015$, $P = .26$) or for age and race (partial $r = -.049$, $P = .40$). Although inactivity is simply the low end of the activity spectrum, activity and inactivity are separate domains from behavioral and analytical viewpoints.[7] Thus, we refer to inactivity independently from activity.

Obesity

There were strong racial/ethnic and age differences in prevalence of obesity; it was highest among Blacks and lowest among Asians. Body mass index (adjusted for age) was inversely associated with activity ($P < .0001$). There was no relationship between amount of inactivity (categorizing television viewing into five groups) and prevalence of obesity ($P = .47$ for trend): the least inactive girls were most obese, thus nullifying the trend. However, in evaluations excluding this group, an increased prevalence of obesity was observed with greater inactivity ($P = .04$ for trend).

Discussion

Our finding that 36% of all girls met the year 2000 goal for strenuous activity corroborates the report of the 1990 Youth Risk Behavior Survey.[8] Both studies report decreased strenuous activity among older girls.

Variation in total exercise between racial/ethnic groups may reflect cultural differences. In Hispanic and Asian cultures, strenuous physical activity may not be considered feminine, or there may be a greater emphasis on academics; however, we have no further information to support these explanations. Alternatively, culture may mediate activity level through the preference for obesity.[9]

Our data suggest that physical activity and strenuous activity decrease, while mild activity increases, with age. Decreased physical activity with age has been reported among both American and Scandinavian youths.[8,10] Activity may decrease in response to social or biological cues. As girls age, they may become more interested in appearance and pursue more sedentary social interests, or they may adopt sedentary, adult-modeled behavior patterns.[11]

Our findings do not corroborate previous reports of an association between television viewing and obesity,[7,12] except when we omit the group watching the least television, which included similar percentages of all racial/ethnic groups but was composed predominantly (40.9%) of high school students. The null finding may reflect a true lack of relationship, may be due to misclassification of inactivity level, or may be caused by obese girls reducing television viewing. We have no evidence for these different explanations.

Limitations of this study include self-reported data. The amount of daily television viewing reported in our study is consistent with some reports,[13] but the weekly average (mean = 26.6) is higher than in others.[7,12] Although our wording was similar to that used in national studies, differences in response could reflect a socioeconomic status lower than that of the general population.

Seasonal differences in physical activity may have influenced our results. In comparison with total activity level in other studies using the same measure, our scores were 28%[14] and 36% to 45%[4] lower in subjects of similar age. Our survey was administered in winter/early spring, which may partially explain the lower activity levels. Ethnic and age differences were detected despite lower overall levels of activity.

Because of a disproportionate amount of obesity-related disease among US minorities, it is essential in future studies to investigate the participation and perception of modifiable behaviors such as physical activity among different racial/ethnic groups. A better understanding of racial, ethnic, and age differences in activity level will permit more effective interventions focused on modifiable risk factors for disease. ☐

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Health Promotion Conference to Be Held in February

The fifth annual conference on "The Art and Science of Health Promotion" will be held February 22 through 26, 1994, at the Broadmoor Resort in Colorado Springs, Colo. Sponsored by the *American Journal of Health Promotion,* the primary focus of the conference is bringing together the practitioners who represent the art of health promotion and the researchers who represent the science. Through this conference, the participants will explore both the art and science of health promotion and work toward bringing these two groups together.

In the past two decades, we have learned that social influences have a tremendous impact on health. Yet, if social influences are so powerful, why have most health promotion programs failed to recognize and protect against the negative social effects and harness the positive effects? At least two thirds of the conference's sessions will be devoted to this theme. The conference will profile organizations and communities that have already developed effective techniques and programs; present clusters of workshops on work and family issues, underserved populations, health care reform, and the concept of social ecology; and offer sessions on a wide range of research, practice, and ethical topics that represent the latest thinking in health promotion.

Past participants include benefits managers, clinical practitioners, consultants, dietitians, epidemiologists, geriatric wellness coordinators, health educators, health promotion specialists, industrial health managers, instructors, nurses, and physicians.

For more information contact the *American Journal of Health Promotion,* 1812 S Rochester Rd, Suite 200, Rochester Hills, MI 48307-3532; tel (313) 650-9600; fax (313) 650-9602.

Safety Behavior among Iowa Junior High and High School Students

Mario Schootman, MS, Laurence J. Fuortes, MD, Craig Zwerling, MD, PhD, MPH, Mark A. Albanese, PhD, and Carol A. Watson, PhD

ABSTRACT

The goal of this study was to determine demographic factors associated with reported safety behavior by studying 2250 Iowa junior high and high school students via a self-administered questionnaire. Students attending rural schools used front seat belts and helmets less frequently than urban students. Seat belt and helmet use and swim safety decreased dramatically with age. Occurrences of driving or riding while drunk or high increased with age. Boys were less likely than girls to wear back seat belts and moped helmets and to check water depth before diving. Possession of a driver's license was not independently associated with any of the safety behaviors. (*Am J Public Health.* 1993;83:1628–1630)

Introduction

Many injuries that occur among 10- to 19-year-olds are preventable. Using seat belts in cars reduces the risk of death in a crash by about 41%.[1] Using helmets on bicycles reduces the risk of head injury by 85%.[2] However, both safety behaviors are least common among those at highest risk (e.g., teenagers) for being involved in crashes.[3] If behaviors associated with an increased risk of injury are to be changed, it is important to know in which group the need for intervention is greatest. The purpose of this study was to determine demographic factors associated with safety behavior among junior high and high school students.

Methods

Data Collection

Data for this study were collected from October 1990 through April 1991 as baseline data for evaluation of a prevention program called the Traumatic Injury Prevention Strategy. This program aims at preventing head and spinal cord injuries among adolescents by increasing the use of preventive measures such as seat belts and bicycle helmets. A self-administered questionnaire measured safety behaviors before the intervention.

Teachers at participating schools who requested that their students become familiar with the Traumatic Injury Prevention Strategy program distributed the baseline questionnaire in a required class. At least 50 students from each school filled out the survey instrument.

Variables

Students were asked about the frequency of their seat belt and helmet usage, swim safety behavior, and driving and riding under the influence of alcohol or drugs. Students answered either yes or no to questions regarding driving and riding while drunk or high. Responses to the other questions were provided on a 5-point scale (never, seldom, sometimes, often, or always).

Demographic variables potentially associated with safety behavior include age, gender, possession of a driver's license, and school location. School location was either urban or rural (schools defined as urban were located in an incorporated area of at least 2500 people).

Stepwise logistic regression was used to determine factors associated with self-reported safety behavior among students. Reported safety behaviors were dichotomized in two categories: often/always or sometimes/seldom/never.

Results

A total of 2250 students from 41 junior high and high schools participated in the baseline survey. The average school had 290 students, with 55 viewing the Traumatic Injury Prevention Strategy program and participating in the study. Table 1 displays the number and percentage of students according to their gender, school location, possession of a driver's license, and age.

Seat belt usage was more prevalent in the front seat (54%) than in the back seat (15%) of a car (Figure 1). Helmets were most often used on all-terrain vehicles and snowmobiles (34%). Bicycle helmets were rarely used (2%).

The results of the logistic regression analysis are presented in Table 2. With the exception of wearing a helmet while skateboarding, the percentage of students who reported often or always engaging in each safety behavior decreased with age after adjustment for other independent variables. The increase in percentage per year was greater for having driven while drunk or high than for having been in a car with

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At the time of the study, Mario Schootman, Laurence J. Fuortes, and Craig Zwerling were with the Department of Preventive Medicine and Environmental Health, Injury Prevention Research Center, University of Iowa, Iowa City. Mark A. Albanese was with the Office of Communication and Research in Medical Education, University of Iowa. Carol A. Watson was with the Mercy Medical Center, Cedar Rapids, Iowa.

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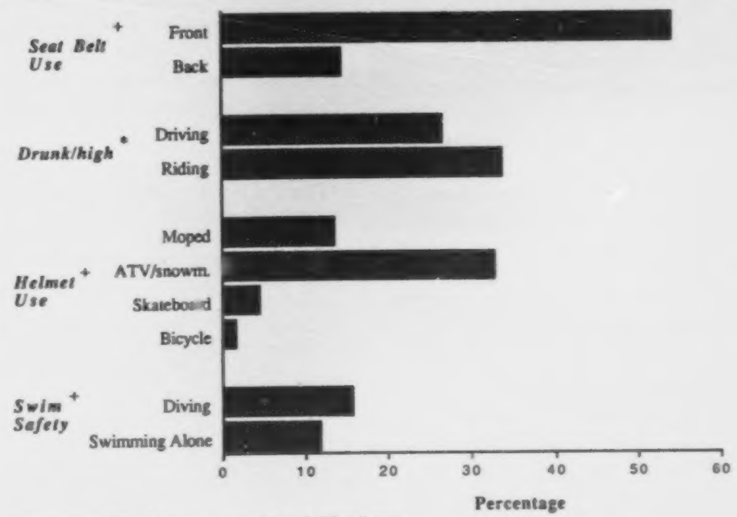
TABLE 1—Demographic Characteristics of the Study Population (n = 2250)

	No.	%
Gender		
Male	1094	48.6
Female	1136	50.6
No answer	18	0.8
School location		
Urban	1044	46.4
Rural	1206	53.0
Driver's license		
Yes	624	27.7
No	1580	70.2
No answer	46	2.0
Age, y		
Mean	14.3	. . .
SD	1.9	. . .
Range	10–19	. . .



+ Responses: Often/always vs. sometimes/seldom/never
* Responses: Yes vs. no

Note. ATV/snowm. = all-terrain vehicle or snowmobile.

FIGURE 1—Percentage of students who responded that they often/always engage in 10 safety behaviors.

TABLE 2—Reported Safety Behavior in 2250 Iowa Schoolchildren: Adjusted Odds Ratios and 95% Confidence Intervals in a Stepwise Logistic Regression Analysis[a]

	Variable		
	Male	Rural School	Age (per year)
Seat belt usage			
Front seat	. . .	0.82 (0.69, 0.98)	0.86 (0.82, 0.90)
Back seat	0.73 (0.57, 0.94)	. . .	0.73 (0.67, 0.78)
Helmet usage			
Moped	0.66 (0.47, 0.94)	0.60 (0.42, 0.85)	0.78 (0.70, 0.87)
All-terrain vehicle/snowmobile	. . .	0.74 (0.59, 0.92)	0.92 (0.87, 0.98)
Skateboard	. . .	. . .	. . .
Bicycle	. . .	0.50 (0.24, 1.01)[b]	0.80 (0.65, 0.98)
Swim safety			
Diving	0.76 (0.60, 0.96)	. . .	0.89 (0.83, 0.95)
Swimming alone	. . .	. . .	1.08 (1.01, 1.16)
Alcohol and drugs			
Driving a car	. . .	. . .	2.25 (1.82, 2.78)
Riding with friend	. . .	. . .	1.46 (1.39, 1.54)

Note. Ellipses indicate that the variable is not included in the model.
[a]For the sex variable, female was used as reference; for location, urban was used as reference.
[b]Although 1 is included in the confidence interval, the likelihood ratio test is significant.

a friend who was drunk or high. Since students have had more opportunity to display the latter two behaviors with increasing age, rates of reported driving while drunk or high by person-years in different age groups were calculated. For driving under the influence of alcohol or drugs, the rate increased with age, while no increase was seen for riding with a friend who was drunk or high.

Students enrolled in rural schools reported wearing seat belts less often in the front seat of a car, and they were less likely to wear helmets on mopeds, all-terrain vehicles and snowmobiles, and bicycles. Male students reported wearing seat belts in the back seat of a car less often than did their female counterparts. Also, they were less likely to wear helmets on mopeds and to check water depth before diving. Having a driver's license was not associated with any of the reported safety behaviors after controlling for the effect of age. Interactions between the included demographic variables did not contribute significantly to the prediction of any of the reported safety behaviors.

Discussion

Students attending rural schools were less likely to wear seat belts while riding in the front seat. This finding is of concern since injury rates on rural roads are higher than on urban roads.[4] As in other studies,[5] age was associated with almost all safety behaviors.

The ultimate goal of injury epidemiology is to intervene in the causal pathway of the occurrence of injuries through preventive measures. Groups with the highest risk of a particular type of injury and the lowest rates of safety behavior are likely to yield the greatest benefits from interventions; however, the results of such interventions depend on the time at which they take place in a person's life.[6] Children progress through different developmental stages at which specific types of prevention can be aimed. Adolescence is characterized by increased risk taking, peer pressure, and feelings of invulnerability. Because it has been hypothesized that educational programs may, at times, have an effect opposite of that intended,[7] it is suggested that children be targeted before they reach adolescence.[8,9]

On the other hand, adolescents are currently not engaging as frequently in safety behavior as are younger children, and they are clearly at highest risk for injuries involving motor vehicles.[10] Therefore, targeting prevention by educating children before they reach adolescence may be more efficacious but would not be sufficient to reduce mortality from motor vehicle and recreational injuries in the group currently at greatest risk. Both age groups should be targeted, and educational interventions need to be rigorously evaluated to determine optimal prevention strategies. ☐

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The Choice of Weapons in Firearm Suicides in Iowa

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ABSTRACT

This study reports the types of firearms used in firearm suicides in Iowa and tests the hypothesis that the use of handguns, rifles, and shotguns in such suicides reflects the availability of these weapons. The percentage of firearm suicides involving handguns increased from 36.6% in 1980 through 1984 to 43.3% during 1990 and 1991. In both time periods, the use of handguns was more likely than would be expected from their household prevalence. Our data suggest that handguns are disproportionately represented among firearm suicides and that this overrepresentation has increased during the last decade. (*Am J Public Health.* 1993;83:1630–1632)

Introduction

In 1988, 18 181 firearm suicides accounted for 53% of the firearm deaths in the United States,[1] outnumbering firearm homicides by almost 5000. Firearms accounted for 60% of all suicides.[1] However, relatively little is known about the types of firearms used in suicides. Nationwide, the specific type of weapon used is not recorded on death certificates in two thirds of firearm suicides.[1] The three studies that have examined the choice of weapons in firearm suicides focused on urban counties.[2–4]

We report on the types of firearms used in firearm suicides in a rural state, Iowa, from 1980 through 1991. In addition, we test the hypothesis that the observed frequency of use of handguns, rifles, and shotguns in firearm suicides reflects the availability of each of these weapons.

Methods

For 1980 through 1984, data on suicides were drawn from the Iowa Master Mortality File maintained by the State Health Registry.[5] For 1990 and 1991, data were drawn from the computerized records of the Iowa state medical examiner.

Data on the prevalence of handguns, rifles, and shotguns in households were derived from the general social survey database of the National Opinion Research Center, a national probability sample of adults living in households in the United States.[6] The Northwest Central census division, which includes the states of Iowa, Minnesota, Missouri, North Dakota, South Dakota, Nebraska, and Kansas, was used in estimating Iowa data. Surveys conducted in 1980, 1982, and 1984 yielded estimates based on interviews of 500 households. Combining the surveys from 1990 and 1991 yielded estimates based on 256 households.

Respondents were asked, "Do you happen to have in your home any guns or revolvers?" Those answering "yes" were asked a follow-up question: "Is it a pistol, shotgun, rifle, or what?" Answers were

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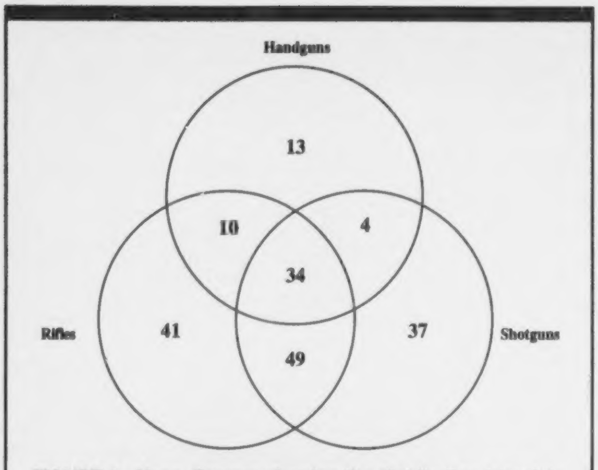

FIGURE 1—Venn diagram showing the distribution (absolute numbers) of guns in the 188 households owning guns in the Iowa Northwest Central census division, 1980 through 1984.

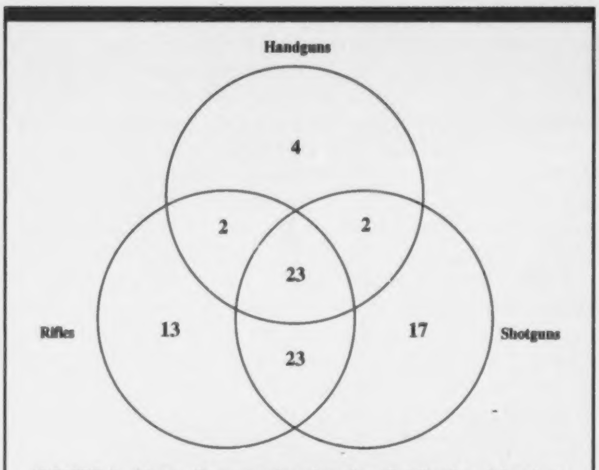

FIGURE 2—Venn diagram showing the distribution (absolute numbers) of guns in the 84 households owning guns in the Iowa Northwest Central census division, 1990 through 1991.

coded yes or no separately for pistols, shotguns, and rifles.[7]

For 1980 through 1984 and 1990 to 1991, 37.6% and 32.8% of respondents, respectively, reported having guns at home. The distribution of type of weapons is shown in Figures 1 and 2. To test the hypothesis that the choice of firearm type in suicides reflected the number of households with that type of weapon, we assumed that in households possessing more than one type of weapon, each was equally likely to be used.[3] We used these proportions to compute expected values for use in firearm suicides. We calculated ratios by dividing the percentage of suicides involving a specific weapon by the expected percentage based on the prevalence of that weapon in the regional population using the National Opinion Research Center data (suicides/weapon prevalence). We calculated 95% confidence intervals using the logarithmic method.[8]

Results

Death certificate records revealed that 877 firearm suicides were committed in Iowa during 1980 through 1984. For 92.5% of them, the type of firearm used was recorded. Handguns were used in 297 suicides (36.6%); shotguns, in 335 (41.3%); and rifles, in 179 (22.1%). The choice of weapons in firearm suicides differed by sex (Table 1). We found the following ratios of suicides/weapon prevalence: 2.20 (95% CI = 1.57, 3.05) for handguns, 1.04 (95% CI = 0.85, 1.25) for shotguns, and 0.51 (95% CI = 0.41, 0.60) for rifles.

Medical examiner's records revealed 292 firearm suicides in 1990 and 1991. For 96.9% of them, the type of firearm used was recorded. Handguns were used in 124 suicides (43.8%); shotguns, in 113 (39.9%); and rifles, in 46 (16.3%). Again, the choice of weapons differed by sex (Table 1). We found the following ratios of suicides/weapon prevalence: 2.69 (95% CI = 1.63, 4.45) for handguns, 0.90 (95% CI = 0.68, 1.19) for shotguns, and 0.41 (95% CI = 0.28, 0.60) for rifles.

A comparison of the years 1990 and 1991 and the years 1980 through 1984 revealed that the proportion of firearm suicides involving handguns increased from 36.6% to 43.8% ($P = .03$ using the normal approximation to a binomial distribution), even though there was no change in the prevalence of handguns in the region (16.7% in 1980 through 1984 and 16.3% in 1990 and 1991).

Discussion

Federal Bureau of Investigation data show that handguns account for a disproportionate share of firearm homicides (75% in 1988).[1] However, the equivalent national data have not been available to assess the contribution of handguns to firearm suicides. In fact, the largest study of the role of handguns in firearm suicides was limited to one urban county (Sacramento County, California). In that study, Wintemute et al.[3] found that, relative to their prevalence in Pacific census region households, handguns were twice as likely to be involved in firearm suicides.

Our study provides the first statewide data to address this issue. We found that handguns accounted for 2.20 to 2.69 times

TABLE 1—Firearm Suicides by Type of Weapon, State of Iowa, 1980 through 1984 vs 1990 through 1991

	Handgun		Shotgun		Rifle		Total	
	No.	%	No.	%	No.	%	No.	%
1980–1984 ($\chi^2 = 28.1$, $df = 2$, $P < .001$)								
Male	248	33.7	318	43.3	169	23.0	735	100
Female	49	64.5	17	22.4	10	13.2	76	100
Total	297	36.6	335	41.3	179	22.1	811	100
1990–1991 ($\chi^2 = 14.8$, $df = 2$, $P < .001$)								
Male	107	40.7	111	42.2	45	17.1	263	100
Female	17	85.0	2	10.0	1	5.0	20	100
Total	124	43.8	113	39.9	46	16.3	283	100

as many suicides as would be predicted by their estimated prevalence in households in our census region. This confirms the results of Wintemute et al.[3] and extends them to a rural region where handguns are much less prevalent (17% in the Northwest Central census region vs 35% in the Pacific census region). It also suggests that the role of handguns in firearm suicides may be increasing.

The use of National Opinion Research Center general social survey data to estimate the prevalence of types of firearms in households has potential weaknesses. First, we assumed that in households with multiple types of guns, any type was equally likely to be used in a suicide. We agree with Wintemute et al.[3] that this is the most reasonable assumption, but other assumptions could decrease the apparent role of handguns. One study of adolescent suicide victims[9] who had both handguns and long guns at home showed that they were slightly, but not statistically significantly, more likely to use a handgun. Second, some[10] have argued that gun owners underreport ownership in surveys. However, survey respondents rarely refuse[11] to answer questions about gun ownership, and a recent validation study[12] suggests that 97% of registered owners report ownership.

Our data suggest that handguns are disproportionally represented among firearm suicide weapons and that the overrepresentation has increased in the last decade. The availability and ease of use of handguns may make them particularly attractive in impulsive suicides. Thus, restrictions on the availability of handguns might decrease suicide rates, particularly among young people, who are most likely to act impulsively. Recent studies support this argument. Loftin et al.[13] found a 23% drop in gun-related suicides in the District of Columbia after the introduction of restrictive handgun licensing, and two recent case–control studies[9,14] showed an association between suicide and the presence of a gun in the home. Taken together, these results suggest that handgun restrictions might well lead to a reduction in suicide rates. ☐

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The Effects of Resistance Strategies on Rape

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ABSTRACT

This investigation sought to clarify which resistance strategies were associated with rape avoidance and at what cost. Data were gathered from initial and supplemental police reports about 150 sexual assault victims, ages 16 and older, who were assaulted between June 1, 1988, and May 31, 1989, in Omaha, Neb. Although this analysis could not determine causality, it did indicate that forceful verbal resistance, physical resistance, and fleeing were all associated with rape avoidance, whereas nonforceful verbal resistance and no resistance were associated with being raped. Further, women who used forceful resistance were no more likely to be injured than women who did not resist. (*Am J Public Health.* 1993;83:1633–1634)

Introduction

A rape is reported in the United States every 6 minutes. Over the last decade, the rate of reported rapes increased four times as fast as the overall crime rate.[1] Although this statistic is alarming, it substantially underrepresents the true incidence of rape. Government estimates suggest that "for every rape reported to police, 3 to 10 rapes are not reported."[2(p3)] Because of these startling statistics, extensive research has been done in the area of rape prevention. However, past research has failed to identify what types of resistance strategies most effectively prevent rape and at what cost. This has led to conflicting advice being offered to women.

Siegel et al.'s interview study, which used randomly selected community residents, found that "resistance particularly verbal, reduces the probability of sexual contact. Physical resistance, on the other hand, is associated with increased likelihood of contact."[3(p31)] Several other researchers reported similar findings with samples of selected subjects who reported the rape to police or sought rape crisis services.[4–6] However, some researchers[7–13] who sampled similar populations found just the opposite to be true. Bart and O'Brien found that "strategies associated with avoidance were fleeing or trying to flee, yelling, and using physical force."[7(p84)]

Because past research about the effectiveness of various types of resistance has been inconclusive, this research was conducted to determine which resistance strategies were associated with rape avoidance and whether physical resistance in particular was associated with additional physical injury. It was hypothesized that more forceful resistance would be associated with rape avoidance but physical resistance would be associated with additional physical injury.

Methods

Data were collected from the Omaha, Neb, Police Department's initial and supplemental reports. The sample consisted of 150 women, aged 16 and older, whose sexual assault occurred between June 1, 1988, and May 31, 1989, and was reported to the Omaha Police Department. Nebraska law requires medical personnel to report to the police any injury sustained because of violence. The sample thus consisted of women who themselves reported the assault to the police or who sought medical attention and whose assault was then reported to the police by medical personnel. It is likely that attacks resulting in injuries, attacks by strangers, and attacks in which resistance was less successful were probably overrepresented in this sample.[8] Despite this inherent bias, however, a finding of a positive association between resistance and rape avoidance with women in this sample should allow us to infer that a similar association would hold for rape attempts not reported to police.

The independent variable, resistance strategy, was defined as any action taken to ward off the attack. This variable was divided into five categories: no resistance; nonforceful verbal resistance (pleading, crying and/or assertively refusing); forceful verbal resistance (screaming and/or yelling); physical resistance (wrestling/struggling, pushing, striking, biting, and/or using a weapon); and fleeing (running, walking away, and/or fleeing in a car). In cases in which several types of resistance were attempted, this variable was coded as the most forceful resistance strategy attempted.

The dependent variables were outcome of the assault and additional physical injury. Outcome of the assault was divided into two categories, raped and avoided rape. "Raped" was defined as having sustained penile, oral, or digital penetration or penetration by an instrument, in all cases under force or threat of force. "Avoided rape" was defined as having sustained no penetration. "Additional physical injury" was also divided into two categories, injured and not injured. "Injured" was defined as having sustained any apparent injury or complained of an injury. "Not injured" was de-

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fined as not having sustained any apparent injury and not complaining of an injury.

TABLE 1—Resistance Strategy by Outcome of the Assault (n = 149)

Resistance Strategy	Outcome of the Assault[a]	
	Raped, % (n = 97)	Avoided Rape, % (n = 52)
No resistance	93.5	6.5
Nonforceful verbal resistance	95.8	4.2
Forceful verbal resistance	50.0	50.0
Physical resistance	45.5	54.5
Running/fleeing	55.0	45.0

[a] $\chi^2(4, n = 149) = 22.93$, $P < .001$.

Results

Of the 150 women in the sample, 64.7% were raped and 35.3% avoided rape, with 46.7% incurring an additional physical injury. Physical resistance was the most frequently selected resistance strategy (44.3%).

We analyzed resistance strategy by outcome of the assault using a chi-square test. Forceful verbal resistance, physical resistance, and fleeing were all associated with rape avoidance. No resistance and nonforceful verbal resistance were associated with being raped (χ^2 [4, n = 149] = 22.93, $p < .001$) (see Table 1).

We analyzed resistance strategy by additional physical injury using a chi-square test. There was no significant relationship between the two variables.

Discussion

This study supports prior research that found an association between physical resistance and rape avoidance.[7–13] It also contradicts other prior research that found an association between less forceful verbal resistance (pleading, crying, etc.) and rape avoidance.[3–6] This study in fact found a negative association between nonforceful verbal resistance (pleading and crying) and rape avoidance but a positive association between forceful verbal resistance (screaming or yelling) and rape avoidance.

The findings of this study, in combination with some past research, provide professionals who are responsible for public health education with direction in planning public educational programs. These findings also counter some prior research on resistance strategies, research that has resulted in inaccurate advice to women to use only nonforceful verbal resistance, or no resistance at all, if faced with a sexual assault. Those types of resistance strategies were shown in this study to be associated with being raped, not with rape avoidance, and they did not reduce the incidence of physical injury.

Because of the contradictory results of past studies, additional research on rape prevention strategies is needed. Special attention should be paid to the temporal sequencing of resistance strategies, outcome, and additional physical injury so that these relationships can be understood. In addition, resistance strategies should be measured so that essentially different strategies are not artificially combined together. For example, if screaming and pleading had been combined into one measure called "verbal resistance," important differences would have been lost. Lastly, future research needs to include women who did not seek medical attention for their injuries or report the assault to the police, women who were not injured, and women who were assaulted by people they knew. ☐

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